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ELECTRICAL WORLD AND ENGINEER.

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ILLUMINATED ELECTRIC SIGNS.

The electric sign is a characteristically modern feature of city decoration. While much of it is distinctly advertising in character, yet it contributes in no small measure to illumine city streets and render them attractive to the passer-by. In spite of the progress that has been made in the electrically illuminated sign, as set forth in our last week's issue, we think that great room still exists for improvement in this direction, and that the future will witness electrically illuminated signs of beauty and elaboration far beyond what has yet been witnessed. There is much room for development in this direction. For example, the present system of summoning vehicles to the doors of a theater after the conclusion of a performance, and which consists in shouting numbers as indistinctly as is conveniently possible through a megaphone, is but a poor makeshift, and a barbarous survival of primitive methods. A far better plan would consist of an electrically operated sign on which the successively required numbers should be conspicuously displayed, and from which the orders, as canceled and completed, could be instantly expunged by the attendant at the operating board. Such an installation would readily become an æsthetic piece of apparatus, but would be a great boon to all the dwellers in the vicinity who retire at a reasonable hour. The operator would only require a keyboard of, say, eight rows, each row having ten numbers, any two of which could be displayed simultaneously. As fast as the tickets of the drivers were handed in a new number could be set up. These numbers could be seen at a greater distance up the street than they could possibly be heard from even the most brazen-lunged stentor.

It will be noticed that we publish in this issue a very interesting article pertinent to this subject, descriptive and illustrative of the illuminations for the second inaugural ceremonies of President McKinley in Washington. Not only was the purely decorative effect fine, but the lavish resort to electric lighting for purposes of advertisement was quite noteworthy. One shortcoming may be mentioned, however, namely, that the signs and decorations were chiefly stationary, whereas the use of electricity permits the fullest employment of change and motion. This advantage can be seen nightly availed of in New York, and was one of the elements of beauty and freshness in the illuminations of the Water Palace at the Paris Exposition last year.

THE BERLINER DECISION.

It is possible both to overrate and to underrate the effects of the decision invalidating the Berliner microphone patent, of which we gave a summary last week. The complete opinion of Judge Brown will probably not be handed down for some weeks, but it cannot differ in any essential respect from his rescript, with the essential points of which our readers are already familiar. While there may be different views on the subject, the general feeling in electrical circles as to the opinion is one of marked approval. It is not too much to say that a prolongation until 1908 of the exclusive rights under "variable pressure" patents enjoyed by the Bell system would have given a moral shock to the community, for there was nothing in the Berliner patent not already in the work of Bell and Edison, and this may be said without any reflection on the entirely original work of Mr. Berliner, whom we venture to regard as an inventor of a high order. His patent is, however, regarded as dead beyond resurrection, and perhaps nobody rejoices at this more than do some of the Bell telephonists themselves. They have had to endure for some

years a campaign of scorn and obloquy, in which, at times and places, some of the worst features of socialism have entered; and the cry of "monopoly" and "fraud" has been worked against them for far more than it was intrinsically worth. Now that cry has lost its power to hurt. It is said by a well-known authority, once in the Bell ranks, that the company has acquired at least 2500 other patents. Some of those, like the Carty bridging bell or the Pupin "boosters" for long lines, have features of considerable importance, but on the other hand, the independent companies have among them all perhaps as many patents now, and patents covering features of intrinsic merit and novelty. Judge Thomas is authority for the statement that the independents have already won 60 patent contests, and are just aching for some more to begin, so that if warfare is to be pushed on "infringement" lines, there will certainly be some very pretty fighting.

But that is only one side of the effect of the decision. Mr. Tyler, whose ability as a telephone manager none will dispute, has put good service first and patents second, and we are fain to agree with him, without in any wise depreciating the value of good patents, or desiring to see them treated as unessential. In the great struggle now beginning, a struggle from which the telephone will emerge a few years hence as a universal rather than a restricted means of communication, the victory is going to rest on the whole with the system giving the best service at the cheapest rate. Hitherto the Bell service has generally been admirable, but the independents have cut the price, and in so doing, while they have often lacked in excellence, they have undoubtedly given the use of the telephone to thousands who could never have enjoyed it under the old régime, so that while the Bell system may now count about 750,000 subscribers, the independent claims 1,500,000, a figure we should be inclined to shade a little. All told, there are less than 2,500,000 subscribers in the United States. There ought to be 5,000,000, and there soon will be. In some territory, like that in which the indefatigable Glidden rolled up new subscribers daily by the thousand, it would really seem as though the immediate possibilities had been exhausted; but even there room exists for growth. No better business for expansion can be asked to-day than that of telephone manufacturing, and, of course, it is going to be overdone.

Where will this great jump in telephony leave the telegraph? That is by no means a small problem. With a telephone in every house the use of the telegraph, except for long-distance work and for press matter, would appear to be sadly limited, and this fact may account for the persistent weakness of Western Union all through these years of prosperity. It has been rumored that some of the independent telephone companies are proposing to develop machine telegraphy on their lines when dull at night. The contrary proposal would be for the telegraph companies to do telephoning by day and also to turn their district messenger systems into local telephone exchanges. There are elements of both strength and weakness in such a plan. At any rate, it is difficult to believe that hereafter the two branches of work can be kept as distinct as they have hitherto been; and the entire electrical community will watch with deep interest to see just what the actual developments may be.

Relatively to electric lighting and electric railway work, telegraphy and telephony have lagged behind in growth of investment and absorption of material. Unquestionably telephony will now make up a great deal of the ground thus unoccupied, and will make large calls for capital, the bulk of which can be profitably employed. In the same manner the new demand for apparatus will be noteworthy, including everything from telephones and switchboards to cables, conduits, storage batteries and generating plants. The interaction of electrical development has always been marked, and the present case is no exception. Indeed, it is one striking feature of the situation that just as a good many early winners in the telephone field put their gains into electric light and power, now many who have made fortunes in electric railroading are investing heavily in independent telephone work.

EUROPEAN ELECTRICAL ENGINEERING.

The paper recently read by Mr. W. J. Hammer before the American Institute of Electrical Engineers enables some interesting comparisons to be effected between electrical engineering enterprises on the two sides of the Atlantic. One remarkable distinction in long-distance electric railway work is found in the adherence to the direct-current motors in the United States and the preference for three-phase motors in Europe. Here we maintain a direct-current car equipment at the expense of transformer sub-stations employing converters. It is the accepted American belief that the better behavior of the direct-current motor relatively to the induction motor, in regard to first cost, torque and efficiency, outweighs the disadvantage of converter sub-stations with their attendance and wear. In central Europe the three-phase system is carried all the way from generator to motor, at the expense of double, and even of triple trolley wires. It is certainly to be hoped that although triple trolley wires should be shunned, the bold example of the European engineers may be followed in this country, for we cannot bring ourselves to believe that the converter is a permanent institution for railroad work. There can be no doubt that the converter has its recognized place in mixed systems of distribution, and in established systems where direct-current equipments are already largely employed; but in cases where the engineer of the railway has a clear path to build a new railway, it seems a pity to have to hitch a direct-current motor service to an alternating-current transmission plant. It must surely be possible so to improve the three-phase motor that it shall be capable of responding to all demands upon it for railway service.

The trolleys themselves are characteristically different in many parts of Europe from those which are in well-nigh universal use in the United States. Here we press a wheel upon the nether side of the trolley wire. There they employ harps pressed against either the side or the bottom of the trolley wire, and the harp string of metal receives the wear and tear. Another plan is to press upwards a metallic groove like a piece of half tubing against the lower surface of the trolley wire, and let the laws of friction take their course It would seem that where the trolley line construction is sufficiently precise, the trolley harps are less likely to fly off the wires than the trolley wheels. As to the frictional wear of the trolley wires opinions differ greatly, and it will probably be some time before experience will have brought about conviction in favor of one or the other system.

The pressures employed in trolley locomotives in this country rarely exceed 600 volts, and are usually about 500 volts. In Europe several thousand volts are in some cases tapped from the trolley wires to transformers carried on the locomotive. Provided that the weight of these transformers is not excessive, this seems to be a good plan, as the high-tension side of these transformers can be thoroughly safeguarded without difficulty. The systems of operating induction motors on electric railways seem to be divided between operating two induction motors in cascade, and operating them each with external secondary resistances. This is a question which en-

gineering experience will no doubt ultimately decide in favor of one or the other of these two rival systems. The former has some advantage in efficiency, and the latter in simplicity and in torque capacity.

The use of SO_2 engines in connection with steam plants is interesting. We only hope, however, that the steam turbines may find commercial development before it becomes necessary to add this new complication to the already enormously complex plant of a large steam power house. Each new improvement in the economy of the steam engine is only attained at the expense of extra first cost and extra complication. First there is the multiplication of cylinders, then the condenser, then the economizer, then the feed-water heater. Now we have the sulphur dioxide engine. What may we not hope for next? If the same economy of steam can be attained or approached by the steam turbine, the simplicity and compactness of the latter should drive the enormously complex reciprocating steam engine out of the field for the purposes of electrical engineering. Rankine maintained that while the double-fluid principle might render an inefficient type of steam engine more economical, yet an equal economy could always be obtained with a properly designed single fluid engine. The double-fluid engine is almost as old as the steam engine itself, and crops up about every quarter century. The sulphur dioxide engine described in Mr. Hammer's paper does not appear to differ in principle from the many two-fluid engines that during the past century have for brief periods occupied the attention of the steam engineering profession and then passed into obscurity.

THE RASCH ARC LAMP.

We print in the Digest this week an abstract of a somewhat sensational paper which appears in the *Elektrotechnische Zeitschrift* for Feb. 14, detailing the results of experiments by E. Rasch on what may be regarded as a modified Jablochkoff candle. Rasch proposes to form the electric arc between pencils of refractory material of composition similar to the filaments of the Nernst lamp. It seems to be the logical step from the Nernst lamp in the direction of still higher incandescence, and the results reported are so extraordinary as to call for somewhat extensive comment. Briefly, Rasch claims to have obtained from such an arc an economy of 5.21 Hefner units per watt, at the melting point of the pencil tip, and working economies of 3 to 4 H. U. per watt, with a clear white light like sunlight, and, at its best, 100 per cent luminous efficiency. To reach these results he forms the arc between pencils of one-tenth to one-fifth of an inch in diameter, the voltage across the arc being 45 to 60, and the current one-half ampere to as high as one ampere per square millimeter of cross section, or 300 to 600 amperes per square inch, as against 25 to 50 amperes per square inch in ordinary arcs. Obviously, such enormous current density should give a very high temperature at the arc, and since the light-giving efficiency of incandescent bodies increases with the temperature, a very large amount of light per watt. Such an arc should give a higher efficiency than the Nernst lamp just as an ordinary arc gives a better performance than an ordinary incandescent lamp. Moreover, at such a temperature as must be reached, a clear white light is to be expected.

If these claims can be substantiated and the lamp can be put in practical form one would expect a startling commercial revolution. The ordinary arc would stand a poor chance compared with such a light at, say, 4 candles per watt, and the incandescent lamp at 3 watts per candle would have but small chance in the competition. But an examination of Rasch's article disposes us to think that aside from all practical questions of construction, there is "something rotten in the State of Denmark." An efficiency of a net 100 per cent is, to say the least, suspicious in view of the known facts regarding the radiation from the substances which Rasch proposes to use. The energy spectrum of a Nernst filament assuredly extends far beyond the limits of the visible spectrum, as its efficiency bears witness, and while raising the temperature undoubtedly increases the proportion of visible and ultra-violet rays, there is not the slightest reason to suppose that it suppresses the infra-red radiation. Hence, until it is shown that the spectrum of Rasch's arc stops short at the red and the violet, one may say with absolute certainty that the agreement of his results with those of Tumlirz on the mechanical equivalent of light merely shows that one or both of these worthies may be in error. Very naturally Rasch does not vouchsafe any such proof as that suggested, and his statement that his arc gives a line and band spectrum besides the continuous one signifies nothing, since ordinary arcs do the same, which, moreover, constitute an exceedingly small part of the total energy spectrum. Broadly, the physical facts are squarely against a luminous efficiency of 100 per cent from any incandescent body, and unless Tumlirz is considerably in error, which is possible enough, there is something wrong with Rasch's efficiencies. It would be interesting to know how the photometric measurements on which the results depend, were made. There is chance enough for error in experiment, but a graver uncertainty surrounds the distribution. Rasch gives no illumination curves, and most if not all of his values of the luminous intensity are in terms of horizontal candle-power. A table of results from electrodes 2.5 mm in diameter worked with an arc length of about 1 mm gave a mean expenditure of 154 watts, an average of 556 English candles for the horizontal intensity or 3.61 candles per watt (0.277 watt per candle).

So far so good, but what was the relation of this horizontal intensity to the maximum and to the mean spherical intensities? The electrodes being without a crater, and with convex terminals at a distance apart less than the radius of the electrodes, one would expect a pretty strong horizontal illumination, perhaps even a maximum at the horizontal, while the mean spherical would be considerably less than this. Now, even the efficiency of an arc between the ordinary carbon pencils is a bit startling if reckoned in the direction of maximum intensity. A couple of 15-ampere arcs tested by Wybauw, unite in showing an economy of 5.11 candles per watt (0.195 watt per candle) when so measured, but their economy on the basis of mean spherical candle-power was about 0.5 watt per candle, which is a very different matter. In enclosed alternating arcs the horizontal candle-power is usually from 1.3 to 1.5 the mean spherical candle-power, and with a similar distribution of light the Rasch arc would show an economy of, say, .35 to .40 watt per mean spherical candle, which is sufficiently remarkable. Taking all the facts together it certainly appears that the Rasch arc probably has an efficiency from one and a half to two times that of an arc between carbons. Comparing arcs of equal candle-power, the latter figure would be probable. If the lamp can be made readily self-lighting and a lamp mechanism suited to the conditions can be obtained, it looks like an important addition to the resources of artificial lighting. With all due allowances for over-enthusiasm, it looks promising, and although the Jablochkoff candle, which involved essentially the same principles, was not saved from commercial oblivion by them, we trust its successor will have better luck. The truth to tell, it is not at all improbable that with a little careful engineering in the light of modern knowledge and methods, the Jablochkoff candle substantially modified could be made to give results of no small practical value. Assuredly both Nernst and Rasch are worthy followers in Jablochkoff's footsteps, and it is their fortune to work in a time riper for success.

February Meeting of A. I. E. E.

At the regular monthly meeting of the American Institute of Electrical Engineers on Feb. 28, Mr. W. J. Hammer read a paper on "Important European Electrical and Engineering Developments at the Close of the Nineteenth Century." The paper gives well-illustrated accounts of a number of recent interesting electrical and engineering developments in Europe. The telephonograph is described at some length, the author during his visit in Europe having had excellent opportunities to make a study of this interesting instrument. The paper gave an account of the Barmen-Elberfeldt suspended electric railway, the result of an investigation of the line by Mr. Hammer. The description given of the Nernst lamp is by far the fullest which has yet appeared. Mr. Hammer has seen the lamp in operation at Paris, Munich, Buda Pest, Gottingen and London, and gives the result of his observations. An account is also given of the Osmium lamp, which Mr. Hammer saw in operation in Vienna. This lamp, the invention of Dr. Auer, of gas incandescent mantle fame, is claimed to show an economy of from .9 to 1-watt per candle. A considerable portion of Mr. Hammer's paper was devoted to heat engines. Among the types considered were the gas engine now commencing to be widely used in Europe, which utilizes the gases from blast furnaces; the new Korting two-cycle gas engine and the Oechelheuser one-cycle gas engine; the De Laval and Parsons turbines, and a late type of sulphur dioxide engine. The final part of the paper dealt with electric traction and gave an account of a trolley omnibus and electric plow, and of the three-phase railway systems of Ganz and Siemens & Halske. The paper ended with a description of the Jungfrau railway.

The Situation in Erie Telephone.

One of the recently elected directors of the Erie Telegraph & Telephone Company says: "I have had an opportunity of scrutinizing closely the earnings of the Erie system for the year 1900 and draw the following conclusions: Erie will earn in 1901 $6,500,000 gross. The cost of operation of the Cumberland (Bell) Telephone Company and the Pacific Coast Company operating a similar class of subscribers in territory of an open, treeless nature is 56 per cent of the gross, while that of companies operating in a coast-bound country, one heavily wooded and whose lines are built on highways like the New England Company, is about 70 per cent; the average of the country is in the neighborhood of 65 per cent, and this would be a very fair charge against the Erie Company's gross, leaving as net earnings $2,275,000; of this amount the Erie will receive 33 per cent and the American Bell and other minority stockholders in the Michigan and Wisconsin Companies 17 per cent.

83 per cent amounts to	$1,888,250
Erie's fixed charges upon its $10,000,000 bond issue and $7,500,000 temporary loan, including commissions, etc., will amount to..	1,000,000
Leaving a sulplus for dividends of.....	888,250

or nearly 9 per cent upon Erie's $10,000,000 stock outstanding.

"Therefore, I see no reason why the usual rate of dividend should not be declared, although we may, from the fact that the company requires a considerable amount of money for extensions, pay dividend No. 70 in April at the rate of 4 per cent per annum."

Automobilism at the Pan-American Exposition.

It is announced that to prepare and carry out the programme of the week of automobile sports in connection with the Pan-American Exposition, including the international race of 200 miles, from Buffalo to Erie and return, W. I. Buchanan, director general of the Exposition, has appointed a special committee of automobilists. The members of this committee, who will act in conjunction with the Sports Committee of the Exposition, were officially notified of their appointment. Mr. Malcolm W. Ford will be chairman of the special committee, and his associates will be Mr. J. M. Hill, who will represent the electric vehicle interests; Mr. Percy Owen, representing the gasolene vehicle interests, and Mr. S. T. Davis, Jr., representing the steam vehicle interests. All four are members of the Automobile Club of America, and Mr. Davis is also president of the National Association of Automobile Manufacturers. The fifth member of the committee is Dr. T. J. Martin, of Buffalo.

While this committee will prepare a list and conditions of all motor vehicle tests at the Pan-American Exposition, its attention will be particularly devoted to the conditions and arrangements of the international speed contest over the famous Buffalo-Erie course. It is intended that this race shall rank with the long-distance automobile competitions held annually in France. It is proposed to raise one large purse by subscription with which to reward the winner, while valuable cups will be presented by the Pan-American Exposition and the Automobile Club of America.

The decision to hold an international race at Buffalo is the culmination of a conference held in that city last week between a committee of the Automobile Club of America, the Sports and Transportation committees of the Pan-American Exposition and William I. Buchanan, director general of the Exposition. The Automobile Club was then invited to take charge of the motor vehicle sports at the Exposition, and the proposition was made that a long-distance road race open to the world, be included in the programme.

Though the Automobile Club of America had placed itself on record as opposing high speed on the public highways, all parties concerned favored the idea of a race, particularly as it was promised that the course would be given over exclusively to automobilists on the day of the event. The Board of Governors of the Automobile Club gave its sanction to the project on this understanding.

The week of automobile sports and tests at the Pan-American Exposition will immediately follow the conclusion of the endurance tour of the Automobile Club of America from New York to Buffalo, the dates being Sept. 16 and 21, inclusive. The club tour, the practical demonstrations of the utility of motor machines and the 200-mile race are calculated to remove all prejudice existing toward horseless vehicles.

American Bell Telephone Finances and Licenses.

The recent decision against the Berliner patent has directed attention to the finances of the Bell organization. The perpetual contracts between the American Telephone & Telegraph Company and its licensee companies specifies that none of the licensees may borrow money or create a permanent debt without the consent of the parent—now the American Telephone & Telegraph Company

The question of funds for the expansion to meet the demands for telephone service has become an important factor, the requirements being greater than originally supposed. In sub-companies controlled by ownership the Bell must take 51 per cent of the increase to hold control. To relieve the parent company from furnishing so large a sum of money the "debt clause" in the perpetual contracts has to some extent been eliminated and many of the subsidiary companies have financed themselves. One plan has been by underlying bonds. While this in a degree might be considered as weakening the value of the stock held by the Bell Company, the money has been so well invested that no special depreciation of Bell assets is apparent. Although the dividends of subsidiary companies have been materially reduced, still their earnings warrant a fair dividend on the money invested.

The Cleveland, Northwestern and Wisconsin subsidiary companies of the Erie system have never issued bonds. The bonds, however, of the following companies have reached the Boston market and have been absorbed principally in Massachusetts: N. E. Telephone & Telegraph Company, East Tennessee Telephone, Sunset Telephone & Telegraph, Duluth Telephone, Cumberland Telephone, Michigan Telephone, New York & Pennsylvania Telephone, The Pennsylvania Telephone, Central Union Telephone Company, Chesapeake & Potomac Telephone, Southern New England Telephone, New York Telephone Company of Canada, Empire State Telephone, Missouri & Kansas Telephone, Iowa Telephone.

Total outstanding bonds of the American Bell Telephone and American Telephone & Telegraph Company are $15,000,000, in addition to the bonds of the subsidiary companies above named.

The American Telephone & Telegraph Company completed the issue of $5,000,000 treasury stock Jan. 15 last. The recent sale of 527 shares at auction by order of the directors brought 161¼ to 161¾. The company required five million more of money by March 1, which it will receive through the issue to bankers of five million of bonds, being the last of a ten million bond issue authorized. The bonds then outstanding will be $20,000,000, equally divided between the American Bell Telephone Company and the American Telephone & Telegraph Company.

Features of Operating the Snoqualmie Plant.

$25 REWARD
WILL BE PAID BY THE
SNOQUALMIE FALLS POWER
COMPANY
For the arrest of any person or persons guilty of wilfully cutting, breaking or otherwise injuring the
WIRES, INSULATORS OR POLES
of said Power Company, and $200 for the conviction of said person or persons. All persons found
INTERFERING WITH THE LINES
of this Company WILL BE PROSECUTED under the laws of this State, which provide for a FINE OF $500, or IMPRISONMENT in the PENITENTIARY FOR TEN YEARS, or both such fine and imprisonment.
CHAS. H. BAKER,
President Snoqualmie Falls Power Co.

FAC-SIMILE OF POSTER.

THE power plant at Snoqualmie Falls for supplying power to Seattle, Tacoma and vicinity met with some unexpected delays in getting into regular and continuous operation, but is now settling down to steady business with a very bright prospect before it. This plant ranks among the greatest water power developments in the United States. The present maximum capacity of the station, with all the machinery running, is 6000 kw nominal, in four units, of 1500-hp each, for all of which there is a ready market.

The Seattle Electric Company, which owns the electric light and street railway systems of Seattle, is now building a station which will contain rotaries and transformers for supplying all of its properties with Snoqualmie power. Its alternating lighting circuits, both arc and incandescent, and part of its railway load are now carried by Snoqualmie. To this will be added the direct-current 3-wire network in the downtown district and 500-volt direct-current power service. The alternating lighting distribution is to be single-phase but connected to two-phase busbars at the station, so that two-phase motors can be run if desired. This company's maximum load, including railway and lighting, is about 4000 kilowatts. A steam plant will also be put in at this substation, and probably a storage battery to carry the peak of the load.

The transmission lines, which carry 30,000 volts, have been practically free from line troubles. Some solid aluminum conductors on one portion of one line had to be replaced with stranded aluminum cables, but aside from that the line has been very satisfactory. There are two pole lines, one to Tacoma and one to Seattle, each carrying two three-phase circuits. For part of the distance the pole lines run side by side, with a wagon road between. Before the lines were started the company secured the passage of a law by the Legislature making it a penitentiary offence to tamper with the transmission lines. Under the law a fine of $500 or imprisonment for 10 years are provided for. The accompanying poster, which is printed on cloth and stuck up along the line, has probably a deterrent effect on mischief-makers, who might otherwise shoot at insulators or throw sticks and wires across the lines.

At the present time the two lines to each city are run in parallel instead of keeping the lighting and railway load on different circuits, as in this way it is found the rotaries have less tendency to pump.

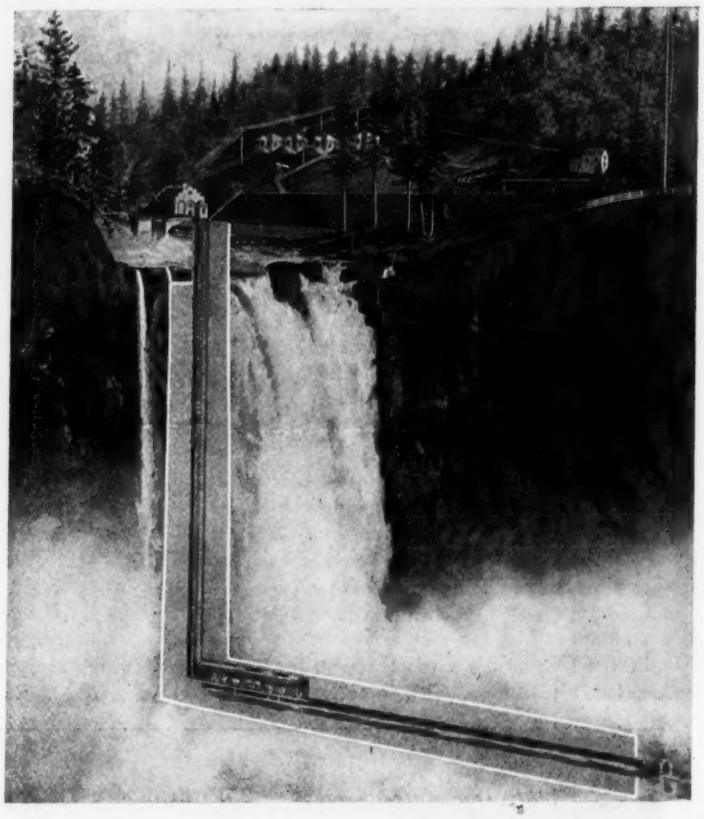
The distance to Seattle from the falls is 32 miles as the circuit runs, and 44 to Tacoma. Some experiments were recently made with transmission through the entire 153 miles of circuit. In these one of the generators was run as a synchronous motor, and it was found that the addition of a non-inductive load lessened considerably the tendency of the motor to pump.

The plant is, as shown in the accompanying cut, in the solid rock at the bottom of a shaft down which the penstock goes. The four 1500-kw Westinghouse generators are each coupled to a set of six tangential jet Doble waterwheels, each wheel with two jets. The speed is 300 r. p. m., which gives the rather high speed of 1½ miles per minute to the armature peripheries. Lombard governors are used. The Doble wheels govern in a peculiar and efficient manner by inserting and withdrawing a needle in the nozzle, which thereby changes the volume of water in the jet without interfering with its form or changing its velocity.[1]

A representative of the ELECTRICAL WORLD AND ENGINEER, by the courtesy of Charles H. Baker, president of the Snoqualmie Falls Power Company, recently spent a very enjoyable evening at the plant at the falls in company with Mr. Robert McF. Doble, consulting and constructing engineer during the installation of the water wheels and completion of the plant. At that time the power house was being operated by two men. The conditions are all favorable for cheap power production. The flow in the river is abundant and constant. There is no trouble whatever with ice. The pole lines are accessible and easily patrolled.

[1] See illustrated descriptive article, ELECTRICAL WORLD AND ENGINEER, Oct. 21, 1899.

The switching of high-tension lines is a matter about which practice the country over has by no means become settled and is in a decidedly evolutionary stage at present. It is therefore of interest to note the arrangements Mr. Doble has completed for connecting transformers on different circuits. This arrangement consists of a plug board somewhat on the principle of a T.-H. arc-circuit switchboard. These plug switches are above the transformers in the transformer house. Running lengthwise of the transformer house over the transformers are 12 angle iron conductors mounted on porcelain insulators, such as are used on the high-tension line. To these the 12 high-tension line wires are connected through long-break switches. Below these line terminals are a set of angle iron conductors running at right-angles to the line terminals and to which the various transformer terminals are connected through high-tension long-break switches. Now it is evident that by a plug the line terminals and transformer terminals can be connected together at the crossing points of these angle iron conductors so as to get any transformer connected to any line. Of course, disconnections cannot be made with the plugs, but that is not necessary, because in such cases the circuit breakers are used, as there is one on each line and each transformer. The angle irons are drilled and bushed for plugs at



THE SNOQUALMIE PLANT.

only such points as will allow the transformers to be connected in the right combination.

Some peculiar effects have been investigated by Mr. Doble in connection with the opening of high-tension circuits. As before stated there are two circuits running to Tacoma and two circuits to Seattle. It was found that upon opening the Tacoma circuits the circuit breakers on the primaries of the transformers supplying Seattle would always go out as if on a short circuit. Vice versa, if the Seattle circuits were suddenly opened out would go the circuit breakers on the primaries of the Tacoma transformers. Much theorizing as to induction, resonance, etc., was indulged in by those who saw the phenomena. The trouble, however, was conclusively proved to be caused by a short circuit on the line due to the discharge of the line through the lightning arresters. The instant the Tacoma circuit was broken the Seattle line current would jump across the lightning arresters to ground. Upon disconnecting the ground wires of the arresters, the phenomena disappeared, showing conclusively that the current jumping across the arresters was responsible for the effects produced. The Westinghouse-Wurts arresters are used, and the line voltage per gap is only about 300, which is extremely low, and makes the effect all the more remarkable.

At Tacoma preparations are being completed by the Tacoma Railway & Power Company for carrying the greater part of its load with Snoqualmie power and using steam for the peak of the load. The Tacoma Railway & Power Company controls the street railway system at Tacoma and furnishes current to the city for its arc and alternating incandescent lighting system. In this installation no rotary converters will be used, as it seems to be the prevaliing opinion that 60-cycle rotary converters for railway load are to be avoided. An induction motor has already been installed for running the cable line, and two 700-hp motor-generator sets are going in to take the electric railway load. Each of these will consist of a 700-hp General Electric induction motor, driving a 500-volt generator. These will be among the largest induction motors in use. In addition to railway load, these 500-volt generators also supply power circuits. Considerable electric power is used along the docks for running conveyors and hoists. The foreign shipping from Tacoma is very large.

East Cleveland, O., Branch Telephone Exchange.

AN exchange which exemplifies very strikingly all the latest departures and features in modern telephone work is that which has just been put into operation at East Cleveland as a branch by the Cuyahoga Telephone Company, of Cleveland, Ohio, situated on Lake Front Avenue about 8 miles from the main exchange. The building (Fig. 1), designed specially for its purpose, is of handsome, unique design, built of pressed brick and gray stone, with the operating room on the first floor.

The operating room will accommodate a switchboard of about 2000 lines capacity around three sides of the room. The distributing room is located in the basement directly under the exchange room, and affords space for the installation of two relay frames, with a capacity of 2160 lines and cut-off relays, two 1200-line distributing frames and two terminal frames for 24 100-pair Cook terminal heads. Only one frame of each type has thus far been installed.

Taking up the exchange room first, as seen in Fig. 2, it may be noted that two six-panel, three-operator sections have been installed. The frame work is of angle iron construction, rigidly braced and covered with moldings and panels of mahogany. The line lamp signals are mounted 20 per strip on ½-inch centers, the strips of lamps and answering jacks appearing alternately, as seen just above the key shelves. The first operator's position is not equipped. The second is used as an incoming trunk position. The trunk lines between this office and the 9600-line, 4-division Kellogg board, located at the main office end at this position in single cords. The third or last position of this section and the middle operator's position on the second section have each answering jacks and line lamp signals for 140 lines, while the first and last positions on the second section are equipped each for 160 lines, making a total of 600 subscriber's lines. Each subscriber's operator's position is equipped with 12 cord circuits, each consisting of a combined ringing and listening key with German silver springs, contacts of 98 per cent pure platinium, and two cords and plugs. Each cord has its own supervisory lamp controlled by individual dust-proof tubular supervisory relays, in a covered box on the rear of the legs of the section above the connecting rack. This

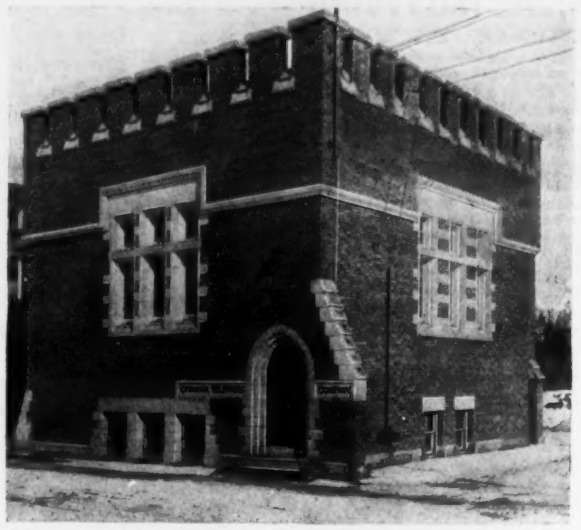


FIG. 1.—EXTERIOR OF EXCHANGE BUILDING.

box contains the condensers, two of which are associated with each cord circuit. The operator's equipment comprises a transmitter arm and solid back transmitter, suspended on two green silk cords, so arranged that the slack in these is automatically taken up as the transmitter is raised or lowered, together with a head telephone and green silk cord with plug attached and a head telephone jack which is located in the front of the keyshelf.

When the subscriber desiring a connection lifts his receiver from the hook his action operates the line relay above mentioned and causes the line lamp or signal to light, notifying the operator of the call. Associated with all the line signals at each operator's position is placed a common relay, known as a "line pilot relay," so wired that when any one of the line lamps is lighted the relay operates to light up a line pilot lamp having a white jewel lens, located in one of the blank multiple spaces, and it also operates the buzzer located in the box panel. The buzzer is used especially at night when but few operators are on duty so to attract attention to the fact that there is a call, when the line pilot lamp shows at a glance at which position it is.

The supervisory or disconnect signals at each position are also

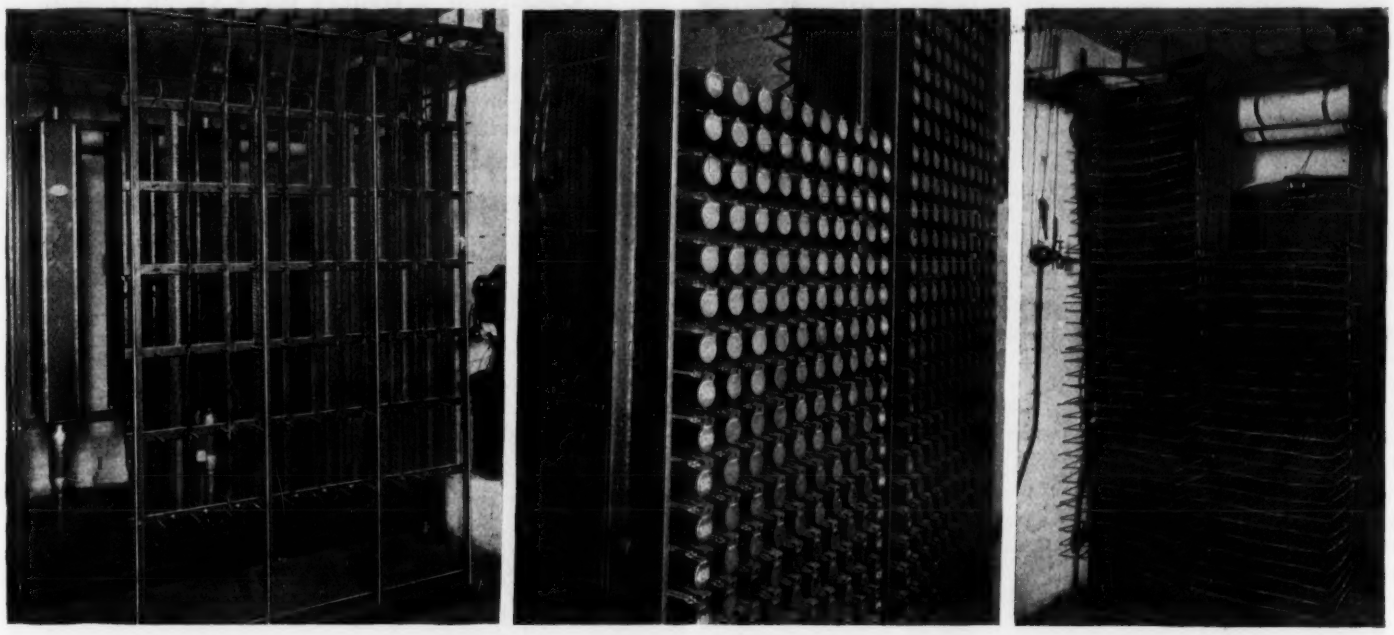
FIG. 2.—BOARD IN THE EAST CLEVELAND BRANCH EXCHANGE

provided with a relay of the same kind which lights a red lens lamp. As soon as a call comes in the operator inserts in the corresponding answering jack one of the plugs of any pair of the 12 cord circuits with which she is provided, at the same time cutting in the corresponding listening key. The supervisory lamp associated with this cord and plug does not light, the receiver on the line plugged into being off the hook. As soon as the operator gets the number required by the calling subscriber, if it is for a similar line at the East office, she picks up the other plug of the pair, and with the listening key still cut in, tests the line desired by touching the tip end of the plug to the brass shell of the multiple jack. Should the line be in use by some other operator she receives a click in her head telephone, and tells the subscriber that the line is busy. Should no click come she inserts the plug and rings up the party called for by simply pressing forward the cam of the listening key above mentioned. When she inserts the second plug the corresponding supervisory lamp at once lights up, indicating that the receiver is on the hook, and when the called subscriber answers this lamp immediately goes out. As soon as the two subscribers finish talking and hang up their receivers the two lamps light up again. This is the signal for the operator to disconnect; this operation puts out both lamps.

If a connection has been established and one of the parties desires to make another call immediately, he can attract the attention of the operator by wiggling the receiver hook up and down a few times. This will flash the supervisory lamp and the operator will cut in on the line and get the desired number and proceed as before. By this method the operator has complete control of the connection, knows exactly whether the parties have answered or are still conversing without listening in on the line, and can handle more lines than she could with the old clearing-out drop system. Where a subscriber is wanted whose line ends on one of the four divisions in the main office, the operator tests in the usual manner and, if it is not busy, plugs into one of the 40 outgoing trunk lines, multipled in the third and fourth panels of each section leading to the incoming trunk position at the main office. By an order-wire key which goes direct to the operator's head telephone at the division wanted in the main office, she tells that operator the connection, and the main office operator designates the trunk. The act of plugging into the designated trunk by the main office operator signals the east office operator, when the latter rings up the main office subscriber called for in the same manner as if the connection were between two lines in the east office. When the main office subscriber hangs up his receiver after completing the conversation, the corresponding supervisory lamp is lighted at the east office, and when the east office operator receives both disconnect signals she pulls down the connection, thus lighting the disconnect lamp at the main office incoming trunk positions, and this operator pulls down for connection. Calls for East Cleveland lines originating in the main office are handled in the same manner at the incoming trunk positions at East Cleveland.

"Incoming trunk" operators have no occasion to cut in on the talking circuit of a subscriber, and have no occasion to use their listening keys, except to secure a busy test. They have no means for ringing subscriber's bells, as the originating operator does this. The latest practice limits an incoming trunk operator to receiving the orders over her order or call wires which are joined to her head telephone, establishing the connections ordered up, and disconnecting when she receives the disconnect signal. It is held that the originating operator is the one who should have complete supervision of the trunking connection, and in case of any special calls, such as calls from pay stations or nickel-in-the-slot machines, this operator is the one who should stay in on the connection to find out whether the calling party has succeeded in securing the party called for, and to see that he deposits his coin in the machine. The trunk circuits installed conform precisely with this rule. A busy back signal apparatus has been installed at both offices to obviate the necessity of the incoming trunk operator cutting in on a subscriber's line to inform him that the line is busy, for it is plain to be seen that she would necessarily lose many orders for connection while so doing. If a line tests busy she simply plugs into one of four busy jacks provided at her position, and pays no attention to that particular cord until she receives the disconnect signal from the other office.

Returning to the distributing room, the power plant and the hot-water furnace for heating the building are located on one side, while the other side has been fitted up as a retiring and locker room A kitchen and pantry, in which there are a gas range and a porcelain sink, adjoin the distributing room. These quarters contain many conveniences for the operators when not on duty, such as sofas, rockers, etc., and on the table may be found the latest magazines and papers. The Cuyahoga Telephone Company has always shown the greatest consideration for the comfort of its operating force. The underground cables, which were furnished by the Standard Underground Cable Company, of Pittsburg, leave the manhole about 150 ft. from the exchange, and enter the basement in a special cement duct 3 ft. wide and 2 ft. deep, covered with iron traps that can be easily taken up with flush rings. From this they are led directly to the 100-pair Cook heads, which are mounted on the terminal frame, as shown in the background on Fig. 3. Switchboard cables lead from these heads directly to the line terminals on the main distributing board, shown in the foreground of the same engraving. These cables are made of 102 pairs of No. 24 tin-copper wire, insulated with two windings of silk and one of cotton, the whole being wrapped with several layers of paper and sheathed in a braided covering. These are all treated previously with hot beeswax, which penetrates to the paper, leaving a dry core and thus providing a perfectly moisture-proof insulation.



FIGS. 3, 4 AND 5.—TERMINAL FRAME AND RELAY FRAMES.

All of the cable used in the installation of this office was made on this plan by the Kellogg Switchboard & Supply Company, Chicago, which also furnished the telephonic apparatus throughout. After being cross-connected or "jumpered" with No. 24 silk and cotton jumper wire from the line or terminal side to the relay side of the main dis-

tributing frame, the lines are carried in 21-pair cables on the cable rack at the top, to the line and cut-off relays at the relay frame, as shown in Figs. 4 and 5, mounted 20 of each per strip, there being space on the relay frame for 18 such strips, or 720 relays in each of the three panels or banks. The function of the line relay is to light the line lamp or signal on the switchboard when a subscriber lifts his telephone from the hook and the cut-off relay "cuts off" this line relay when the operator inserts the plug in answering the call, thereby putting out or restoring the line signal.

From these relays the lines are carried by 63-wire cable through a running box to terminals on the connecting rack located on the rear of the legs of the switchboard, and are thence carried in 24-pair cables through a box panel at the left end of the first section to the multiple jacks appearing in each section. From these terminals, on the inside or front of the connecting rack, 63 wire cables are carried to the answering jacks and line lamps.

In Figs. 6 and 7 are shown the power plant and battery room. The plant consists of two Roth motor-generators for charging the two 10-cell sets of storage batteries. These machines receive current from a 500-volt trolley circuit and deliver 30 amperes at 28 volts. There are also two Roth ringing machines to supply current for ringing the subscribers' bells, one having a 500-volt primary and the other being wound to take current from storage battery, both machines giving 100 volts, pulsating and alternating. The busy back signal

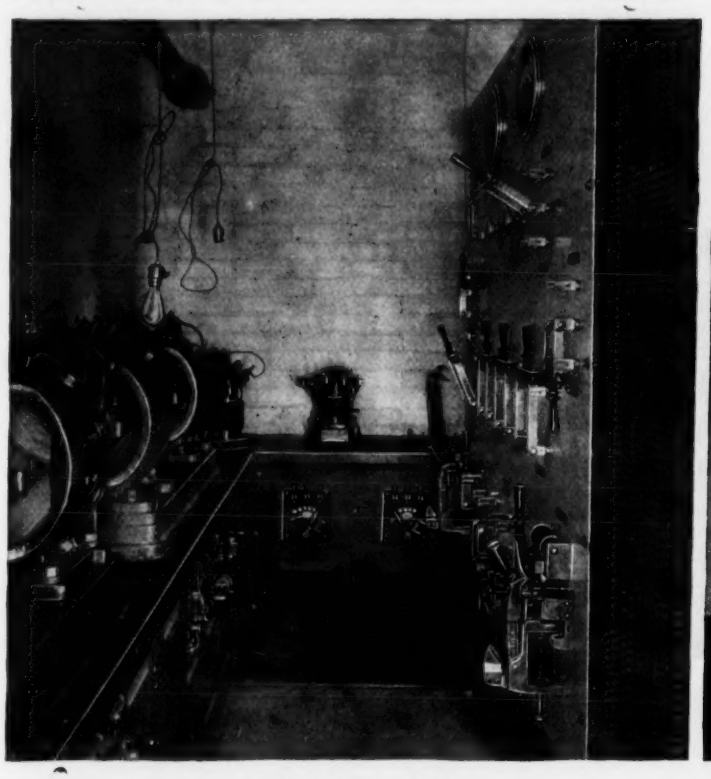


FIG. 6.—POWER PLANT.

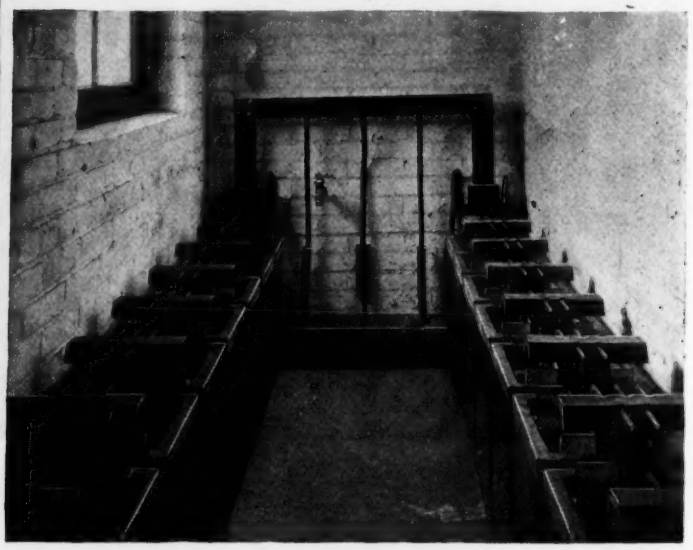


FIG. 7.—BATTERY ROOM.

apparatus is driven by a 1-6-hp Roth motor, which is also supplied from the storage cells. These machines are mounted on a specially designed iron frame work, which is covered with paneling stained to match mahogany. The power switchboard consists of an Italian marble slab, 60 by 60 by 1¼ inches, with polished surface and beveled face edges, mounted in an iron frame, at the right in Fig. 6. It carries a Weston round pattern, flush type voltmeter, double scale, reading from 0 to 600 and 0 to 60, and a Weston round pattern, flush type ammeter, with six shunts and 100-ampere scale. Each of these instruments is controlled by switches having copper-plated hand wheels with index plates stamped for eight and six circuits, respectively. Two copper-plated Midget, 28-volt under-load and overload I. T. E. circuit-breakers protect the charging circuits. Twelve all-copper back-connected jack-knife switches are also provided, eight on the charging and four on the discharging circuits. The above apparatus is back-connected, and is wired in a very neat and attractive manner. The battery plant consists of two sets of "American" storage battery, each set comprising 10 cells, in lead-lined tanks, and the capacity of 100 ampere-hours per cell, which is sufficient for the present line equipment. Large tanks have been provided, however, so that plates may be added as the exchange grows.

From the batteries and from the power switchboard leads are carried direct to a fuse board which consists of a slate slab, 42 by 60 by 1¼ inches, mounted in an iron frame and located adjacent to the power board, as shown at the extreme right of Fig. 6. On this board are located fuses for all of the circuits. Individual rubber-covered wires, No. 20, B. & S. gauge, are brought from each strip of 20-line lamps, from each set of supervisory or disconnect signals and from each strip of 20-line relays. Each operator's transmitter is connected up by a twisted pair of No. 18, B. & S. gauge, rubber-covered wires. The battery connection is carried to each cord circuit for talking in 15-pair switchboard cable, each fused on this board. The connections are all soldered to the fuse studs on the rear, projecting through to the face, where each one is fitted with a cap screw, under which the fuse is held. No wiring whatever appears on the face of the board, and each set or group of fuses is numbered or labeled so that trouble may readily be located in any circuit.

The building is lighted throughout by electricity, the switchboard being illuminated on the front with three 110-volt, 16-cp lamps. The lamp brackets are finished in black and are provided with one-half-green shades. On the rear each section has a porcelain base keyless socket and lamp located in the roof. The power and distributing rooms are equipped with an adequate supply of lamps.

We are indebted for the above details to Mr. George L. Burlingame, of the engineering staff of the Kellogg Company, who had charge of the installation of this interesting equipment.

Calculating a Battery for a Given Output.

BY DR. K. NORDEN.

THE calculation of storage batteries for given discharge rates has become to-day a matter of growing interest by reason of their increased application in lighting and power plants. Of course, nobody would select batteries just exactly corresponding to the given output, but for the purpose of determining a sufficient power reserve also, a reliable method is wanted.

Two papers have been published recently on this question in German journals, and were noticed in the Digest, Nov. 17, 1900, and Jan. 12, 1901. The difficulty of the problem is due to the circumstance that the capacity of a battery depends to a certain extent on the rate of discharge, so that it diminishes when the current increases. Thus, a certain amount of ampere-hours discharged represents a greater part of the total capacity if put out with a greater current, therefore one cannot simply add the ampere-hours consumed at different discharge rates without reducing them to a common basis. This reduction requires, of course, a knowledge of the relation between capacity and discharge current for the type of plates in question. Several formulæ have been suggested for this purpose, and, in fact, every method of solving the problem by mere calculation is based on their use. Thus one of the papers mentioned above (Rossander and Forsberg, *Elektrotechnische Zeitschrift*, Oct. 25, 1900), arrives at a rather inconvenient expression of the total capacity, applying the well-known formula, $TI^{1.4}=K$. The other paper, by E. Suchy (*Zeitchrift fuer Elektrotechnik*, Dec. 16, 1900), assumes a proportionality between capacity and current, and leads consequently to a very simple formula. But generally the hypothesis is only admissible for a dis-

charge rate of four, five or more hours, whilst in the very frequent case of more rapid discharges the formula become inapplicable.

This relation, however, cannot be exactly represented by formulæ, but by graphic processes only, based on the special data usually supplied by the manufacturers in their catalogues. A graphic method of this class is adjoined to the calculations of Rossander and Forsberg. But the construction employed is too complicated, owing to the great number of units employed; moreover, the total capacity is obtained as an area, so that a final integration is still necessary.

On a similar basis I devised a simple method of calculating batteries, described below, which was developed in the scientific laboratory of the Accumulatoren-Werke System Pollak, Actien-Gesellshaft, in Frankfort-on-Main, Germany.

The variable output is generally given in numbers; i. e., by the number of lamps used in a certain time, and may serve then directly as a basis for the construction. Sometimes the battery load is given in the form of a discharge curve (Fig. 1). In this case the area enclosed by the curve must be resolved into a number of rectangles, the height of which corresponds to the average currents and the width to suitable units of time, hours, for instance, as shown in Fig. 1. The diagram may be laid down, once for all, in the following way:

Starting from a point, O (Fig. 2.), on a horizontal basis, draw at right angles the line, $O1$, which represents the discharge capacity of a battery at a one-hour rate in a suitable scale, the capacity being taken from the price list. From 1 draw a line $\overline{1n}$ parallel to the basis. Now the capacities for 2, 3, etc., hours discharge are drawn

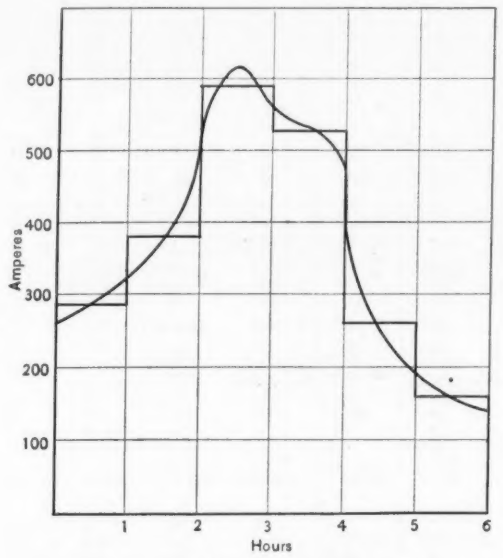


FIG. 1.—CALCULATING BATTERY OUTPUT.

from O as vectors, which cut the horizontal $\overline{1n}$ in the points 2, 3, etc.; this operation is easily performed with the aid of a pair of compasses. Having done this, take in every capacity vector from O a length corresponding to one hour's discharge, i. e., in O 3 a third ($O3'$), in $O6$ a sixth ($O6'$), etc., of their own length. The points, 2', 3', joined from the curve 1, 2', 3' of currents, which correspond to the particular discharge capacities, thus in the diagram amperes and ampere-hours have the same unit.

As a basis for the continuation of the construction, only one of the vectors—for instance, the vector of three hours' capacity—and the current-curve are necessary, both having been constructed once for all.

The further steps of the method are given in Fig. 3 in an example for the output represented in Fig. 1. At first it is necessary to estimate the value of the total capacity by conjecture or by simple addition of the ampere-hours given. Thus the approximative value of the capacity (Fig. 1), is in the example about 2200 ampere-hours at a 6-hour discharge. For this output we find in the price list of the manufacturer a type of cell with 2270 ampere-hours capacity at a 6-hour discharge, or 1950 ampere-hours at a 3-hour rate. Now the length of the vector, $O3$, represents the 3-hour capacity of 1950 ampere-hours, as found out above, the scale for our diagram being thus fixed for the present example. Granted that the length of the vector be about 12 inches, 1 inch will represent a capacity of $\frac{1950}{12} = 162$ ampere-hours, this being the unit of the construction.

Describe now an arc with O as center and with the first current of the curve, Fig. 1 (286 amperes equals 1¾ inches), as radius, cutting the current-curve 1, 3' O in A. Draw a vector from O towards A and take in it from O the amount of ampere-hours discharged at this current rate, which in this particular case coincides with $\overline{OA}$, as the time of discharge is exactly one hour. For a discharge of half an hour, of course this length would have been $\frac{\overline{OA}}{2}$ etc. Now, from the point thus obtained draw a horizontal line cutting every imaginable vector of the diagram in the same proportion. In this way, on each vector is cut off the equivalent for the capacity, $\overline{OA}$,

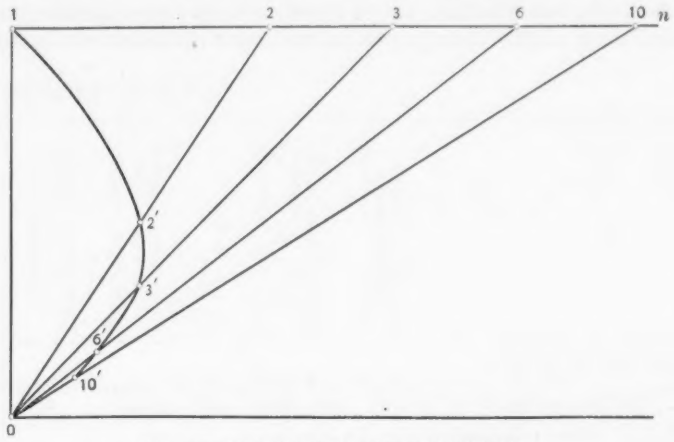


FIG. 2.—CALCULATING BATTERY OUTPUT.

discharged at the particular current. The next current cuts the curve of currents in B; draw then again a vector through B. Find out the respective capacity from Fig. 1, in this case, OB, and take it in the produced vector, starting now from the point, A', where the horizontal through A cuts off on the vector $\overline{OB}$ the ampere-hours consumed until now. Thus the new capacity $\overline{A'C}$ is added geometrically to the former. After this draw again a horizontal through C and continue the simple operations described in the same manner for the other currents, until the last horizontal cuts the 3-hour vector in N.

Every step of the process is marked in the figure by the respective horizontal lines. Suppose N coincides with 3, the chosen battery would be just suitable. If N lies below the point 3, the battery was chosen too large, if above, too small. In our case the right type of battery ought to be smaller than that corresponding to the length $\overline{N3}$, equal to about 3-16 inches or 30 ampere-hours; accordingly a new type must be chosen. If the difference is rather considerable, it would be advisable to repeat the construction with another size of

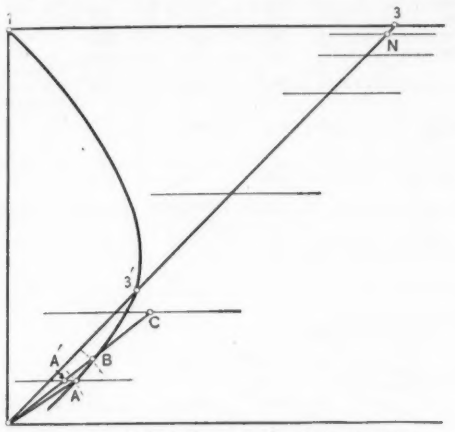


FIG. 3.—CALCULATING BATTERY OUTPUT.

battery, as the proportions are always a little altered by the choice of another scale. This cut-and-try process will generally give a quite satisfactory result.

Wireless Telegraph Repeaters.

A dispatch received from Ostend says that M. Guarini is about to attempt to establish a wireless telegraph system between Brussels and Paris, a distance of 171 miles. There will be transmitters at every 17 miles of the distance. It is said that the first signal will be automatically repeated from one set of instruments to another. The experiment will cost about 100,000 francs.

European Types of High-Tension Alternators—VIII.

BY C. F. GUILBERT.

(Concluded.)

THE Compagnie de Fives-Lille exhibited at Paris an alternator (Figs. 69, 70 and 71, page 400), direct-connected to a compound engine from the same works, which is of interest on account of the type of armature winding employed. This winding has 5 turns per complete coil, in 4 slots, each of which thus contains but 2½ turns. As each turn is formed of 4 wires in parallel, each coil is composed of 2 wide turns, that is to say, wound in extreme slots corresponding to that coil; 2 narrow turns wound in the inside slots and one mixed turn wound in an extreme slot, and one inside for each of the two groups of two wires in parallel, which are separated during the winding. Such a winding can be very simply put on without crossings, as is shown in Fig. 67, on which each of the full or dotted lines is supposed to represent a group of two wires in parallel.

There remain to be mentioned two other alternators exhibited at Paris, the data of which as well as of all the other alternators mentioned in this article, are given in the accompanying table. One of these was a machine exhibited by the General Electric Company of Nancy, direct-connected to a Weyher & Richemond monocyclic motor with a special flywheel. This machine during the Exhibition furnished current for an Alioth rotary converter. The Societe Alsacienne showed an armature of a machine identical with those in-

DATA OF EUROPEAN ALTERNATORS.

	Allgemeine Elektricitats Gesellschaft.	Helios Elektricitats Aktien Gesellschaft.	Siemens & Halske.	Elektricitats Aktien Gesellschaft (Lahmeyer).	Elektricitats Aktien Gesellschaft (Schuckert).	Parsons.	Ganz (Leobersdorf.)	Elektricitats Aktien Gesellschaft de Prague (Kolben).	Compagnie Internationale d'Electricité de Liege.	Société Anonyme Electricité et Hydraulique de Charleroi (Heyland).	Société Anonyme Electricité et Hydraulique de Charleroi (Heyland).	Ganz (Budapest).	Brown, Boveri & Co.	Oerlikon.	Rieter, Winterthur.
PRINCIPAL CONSTANTS.															
Type of machine	3-Phase	3-Ph S-Ph	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Ph S-Ph	3-Phase	3-Phase
Apparent output, kilowatt-amperes	3000	3000 2000	2000	1000	850	500	1200	780	1000	760	350	1200	1760 1000	1375	700
Power factor, minimum at full load	0.9	0.7 0.7	.....	0.7	.....	1	0.7	0.85	0.85	0.85	.....	0.7	0.85 1	0.8	0.8
True output, minimum power factor, kilowatts	2700	2100 1400	.....	700	....	500	840	665	850	650	....	840	1500 1000	1100	560
Voltage at terminals	6000	2200	2200	5000	5000	2200	2200	3000	2200	2200	2000	2200	6000 6000	5500	3300
Voltage per phase	3465	2200	1270	2890	2890	2200	2200	1730	1270	2200	2000	2200	3565 6000	3170	1900
Current, amperes per phase	288	788 910	525	115	98	230	182	150	262	115	175	182	170 170	145	123
Speed, r. p. m	83.3	71.5	83.3	93.8	83.3	2400	126	93.8	83.3	79.7	142	125	83.3	93.8	100
Frequency	50	50	50	50	50	80	42	50	50	42.5	42.5	50	50	50	50
FIELDS.															
Number of field poles	72	84	72	64	72	4	40	64	72	64	36	48	72	64	60
Length of pole pieces parallel to axis, cm	56	35	58	30	40	....	39	40	15	25	28	31	33	28.5	24
Width of pole pieces, cm	24	20	17	20.5	18	.....	22	16.5	16	15	73.5	16.5	20	12.5	13
Kind of metal in pole pieces	laminat's	steel	laminat's	iron	steel	.....	steel	laminat's	steel	steel	steel	steel	iron	laminat's	steel
Section of cores	rectang'r	circular D=21 *cm*	rectang'r	circular D=18 *cm*	oval	.....	circ { 25 D= { 23	oval	circ. D= 13.5 *cm.*	oval= 200 *cm²*	oval	circ. D =19	circular	rectang'r	circular D=14 *cm.*
Kind of metal in cores	laminat's	steel	laminat's	steel	steel	.....	steel	steel	steel	steel	steel	steel	iron	laminat's	steel
Diameter of field at pole faces, cm	739	800	597.2	178.4	548.4	. . . .	408 8	555	550	598.4	308.8	413.8	690	499.1	442.2
Tangential speed, metres per second	32.2	30	26	28.8	24	....	27	27.2	24	25	23	27.2	30.2	22	23.2
Diameter of fly-wheel, cm	671.8	740	528	533	486	.....	370	480	510	565	268.8	370	.....	490	ext. 580 int. 495
Width of rim of fly-wheel, cm	73	80	60	84	60	.....	67	42	61	32	39	71	....	75	97.5
Kind of field winding	bars	ribbon	ribbon 23x4 *mm.*	ribbon	flat cable	.....	ribbon 25x3 *mm.*	ribbon 25x4 *mm.*	square	ribbons 104x.8*mm*	wire	ribbon 20x3.5*mm*	ribbon	wire	square
Sector of field conductor, square mm	.....	.....	92	.....	.....	.....	75	100	42	83.2	21.2	70	....	95	36
Number of turns per coil	90	50	40	34	.....	.....	55	60	105	50	176	50	45	54	137
Number of field circuits in parallel	2	1	1	1	1	.....	1	1	2	1	1	1	1	1	1
Resistance of field circuit, ohms (warm)	.....	0.7	1	0.25	.....	....	0.42	0.728	0.5	0.7	4.5	0.45	0.33	0.7	2.73
Weight of copper in field, kgms	.....	3500	4000	..... .	.....	.. ..	.....	3240	.....	2100	920	....	.....	.....	1500
Weight of field complete, without shaft	70000	76000	38000	54000	26150	....	20000	24700	39000	20200	12700	24000	.....	.....	.....
ARMATURE.															
Air-gap, mm	10	12	14	8	8	.....	6	5	8.5	8	6	6	10	4.5	11
Diameter of armature at air-gap, cm	741	802.4	600	580	550	.....	410	556	551.7	600	310	415	692	500	440
Radial depth of laminations, cm	25.5	18.5	14.3	25	10.5	.....	22.5	18	18.5	20	17	22.5	.....	24	18
Useful length of armature, cm	52	31	58	30	36	... .	34	40	13.5	23	26	28	30	30	24
External diameter of armature frame, cm	860	940	680	692	610	....	502.6	680	640	726.5	384	502.6	786	620	404
Total width of armature frame, cm	120	84	150	163	90	.....	90	82.4	90	64	65	85	.....	92	44
Kind of perforations	slots	slots	slots	circ. slots almost closed	rect. slots half closed	.....	rect. slots half closed	slots	slots	oblong tunnels	oblong tunnels	rect. slots half closed	oblong tunnels	slots	oblong tunnel
Number of perforations per pole	15	8	9	6	3	.....	9	3	6	6	2	7½	6	3	3
Kind of armature winding	bars	coils	bars	coils	coils	.....	coils	coils	coils	coils	coils	coils	coils	coils	coils
Number of coils or bars per phase	360	84	216	32	36	.....	60	32	72	32	36	60	36	32	30
Grouping of coils of each phase	series	3 series in parallel	series	series	series	.....	series	series	series	series	series	series	series	series	series
Number of turns per coil	....	.. ....	.....	12	.....	.....	4	6	5	12	11	4	12	11	12
Number of conductors per perforation	1	....	1	6	.....	.....	4	6	5	6	11	4	6	11	12
Kind of armature conductors	bars	cable	bars 44x7 *mm.*	wire	wire	.....	cable 19 wires 1.6 *mm.*	.....	wire	cable 19 wires 1.3 *mm.*	cable	cable 19 wires 1.6 *mm.*	wire	4 wires of 3.8 *mm.* in parallel	3 wires of 4.2 *mm.* in parallel
Section of armature conductors, square mm.	93	.....	308	.....	.....	.....	38	... .	36	25	33.6	38	.....	45.4	41.6
Resistance of armature per phase, ohms (warm)	0.098	.....	0.014	0.34	0.49	.....	0.21	.....	0.125	0.52	0.336	0.185	.....	0.25	0.25
Weight of copper in armature, kgms	.....	.....	2400	....	.....	.....	400	.....	240	500	162	360	.....	.....	550
Weight of armature, with or without foundation plates, kgms	80000	80000	44000	55000	14350	....	23000	27000	20500	20000	7400	.....	.....	.....	.....
TESTS.															
No-load exciting current	.....	120	120	131	.....	....	86	86	110	137	40	120	175	86	43
Exciting current for normal current on short circuit	.....	.....	42	49	. .....	.....	48	22.5	75	43	12	48	60	33	15
Full-load exciting current { *cos* ϕ = 1	.....	.....	135	155	.....	.....	.....	92	136	155.5	45	.....	193	.....	.....
Full-load exciting current { *cos* ϕ = min'm.	.....	185	.....	.....	.....	.....	180	105	160	193	.....	200	232	120	57
Full-load drop, per cent { *cos* ϕ = 1	.....	....	9	3	.....	.....	5.5	2.5	7	4	8	5.5	5	.....	.....
Full-load drop, per cent { *cos* φ = minimum	.....	....	.....	.....	.....	.....	75	7.5	11	10.5	.....	15	14	18	.....
No-load losses (hysteresis, eddy currents, ventilation)	.....	.....	.....	22200	19000	.....	.....	....	.....	.....	.....	.....	.....	30000	.....
Copper losses, watts	25000	.....	11600	13700	14000	.....	21000	.....	26000	20500	10300	18500	.....	15800	11400
Full-load losses, watts { *cos* φ = 1	.....	... .	18200	13800	18000	.....	....	6150	18500	17000	9100	... .	12300	....	.....
Full-load losses, watts { *cos* ϕ = minimum .	31000	24000	.....	.....	.....	.....	13600	8000	25500	26000	.....	18000	17800	10100	8900
Efficiency, per cent, { *cos* ϕ = 1	.....	....	.....	95.3	94	... .	.....	.....	.....	.....	.....	.....	.....	.....	.....
Efficiency, per cent, { *cos* ϕ = minimum	... .	.....	.....	... .	.....	.....	.....	... .	.....	.....	.....	.....	. .....	95	.....

stalled by the manufacturers in the three-phase station at Asnieres near Paris, and in the tramway power house at Marseilles. The machine is intended for furnishing current for rotary converters.

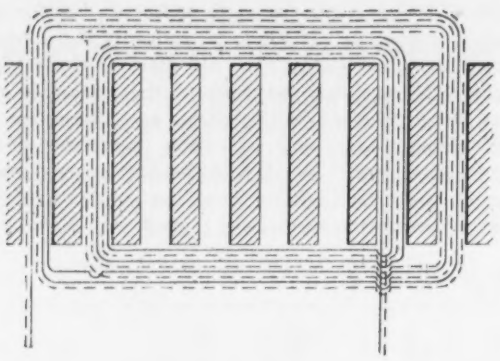
In the accompanying table there are given, as far as could be obtained, construction data of the tests of a number of the machines.

Improving Means of Transportation.

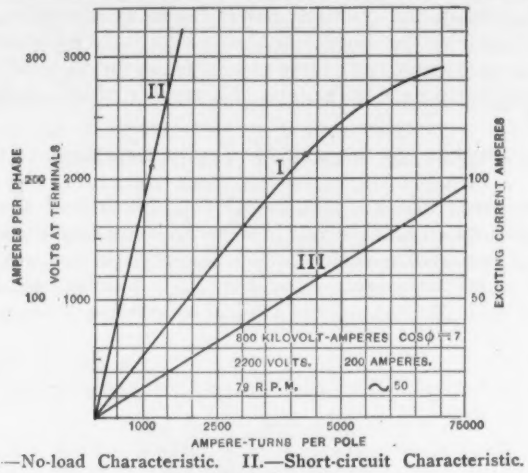
At a recent conference in England, Mr. C. Booth read a paper in which he maintained that the way to better existing conditions was to improve the means of communication. His remarks brought a contribution to the controversy from Mr. A. J. Balfour, who agrees thoroughly with Mr. Booth, and suggests a scheme of his own for improved means of locomotion. He says that there are other means of transit besides trams, railways and tubes, and adds that he would like to have an expert examination of a system of radiating thoroughfares, confined to rapid (15 miles an hour or over) traffic, and with a surface designed, not for carts or horses, but for some form of automobile propulsion. If the local authority chose to run public autocars over them, well and good. Mr. Balfour claims that in such a thoroughfare there would be none of the monopoly inseparable from trams, the number of people carried could be much larger, the speed much greater, the power of taking them from door to door unique, while there would be none of the friction now caused when the owners of street car lines break up the public streets. He feels certain that an absolutely satisfactory autocar will soon be devised.

DATA OF EUROPEAN ALTERNATORS.

Oerlikon.	Thury.	Oerlikon.	Alioth.	Creusot (Ganz).	Société L'Eclairage Electrique (Labour).	Compagnie Française Thomson-Houston.	Farcot.	Grammont (Routin).	Breguet (Boucherot) (Materiel Boucherot).	Fives-Lille.	Jeumont (Heyland).	Nancy.	Société L'Eclairage Electrique (Materiel Labour).	Société Alsacienne Belfort.	
															PRINCIPAL CONSTANTS.
3-Phase	2-Phase	S-Phase	3-Phase	3-Phase	3-Phase	3-Phase	2-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	S-Phase	3-Phase	Type of machine
650	460	350	176.5	1400	1200	1000	880	860	875	800	760	450	180	1330	Apparent output, kilowatt-amperes
0.8	0.9	0.8	0.85	0.8	0.5	1	0.9	0.7	0.8	0.7	0.85	0.8	0.7	0.9	Power factor, minimum at full load
520	410	280	150	1120	600	1000	790	600	700	560	650	360	125	1200	True output, minimum power factor, kilowatts
7500	5000	2200	3000	3000	5000	5500	2200	2400	2200	2200	2200	3000	30000	5500	Voltage at terminals
4330	5000	2200	1730	3000	2890	3170	2200	1385	1270	1270	1270	1730	30000	3170	Voltage per phase
50	46	160	34	156	138	105	200	207	230	210	200	87	6	140	Current, amperes per phase
250	350	250	37.5	71.5	79	75	78.5	93.8	250	79	93.8	93.8	428	75	Speed, r. p. m.
50	46.6	50	50	50	50	25	42	50	50	50	50	50	40 to 60	25	Frequency
															FIELDS.
12 per crown	16	12 per crown	8	84	76	40	32 per crown	64	24	76	64	64	14	40	Number of field poles
.....	52	15 per crown	17.75	25	40	44.4	28 per crown	25.5	60	26	25	.....	.. .. ..	40	Length of pole pieces parallel to axis, cm
.....	19	22	26	16	18	178	27	15	.....	20	15	.....	.....	27.5	Width of pole pieces, cm
laminat's	laminat's	laminat's	laminat's	steel	steel	laminat's	laminat's	steel	laminat's	laminat's	steel	steel	soft steel	laminat's	Kind of metal in pole pieces
rectang'r	rectang'r	rectang'r	rectang'r	circ. D = 16 *mm.*	rectang'r	rectang'r	rectang'r	circ. D = 16.5	.....	rectang'r	oval = 20000	oval	rectang'r	rectang'r	Section of cores
laminat's	laminat's	laminat's	steel	steel	steel	laminat's	laminat's	steel	laminat's	laminat's	steel	steel	soft steel	laminat's	Kind of metal in cores
.....	.....	219.2	129.3	638.8	569	354	550.2	498.6	219	598.6	598	448.8	124.8	537.8	Diameter of field at pole faces, cm
.....	.....	28.8	25.4	24	23.5	14	22.7	24.5	28.7	24.8	29.4	22	28	21.8	Tangential speed, metres per second
.....	112	189	86	603.8	536	311	518	390	178	556	565	....	.....	477	Diameter of fly-wheel, cm
.....	65	71	57	66	65	61	92	72	75	65	32	.....	.....	50	Width of rim of fly-wheel, cm
ribbon 60x2 *mm.*	square	ribbon 60x2 *mm.*	.....	ribbon 25x3 *mm.*	wire 8 *mm.*	ribbon 38 x 2.3 *mm.*	wire 7.5 *mm.*	ribbon 19x3 *mm.*	cable	wire 4.7 *mm.*	rib'n 106 x 0.8 *mm.*	flat cable	wire 7.1 *mm.*	rib'n 110 x 1 2 *mm.*	Kind of field winding
120	.....	120	.....	75	50.3	87.5	44.2	57	.... .	17.35	83.2	46	40	130	Sector of field conductor, square mm
166	.....	150	.. ..	45	44	67-68	460	70	20 copies	155	50	.....	96	48	Number of turns per coil
1	2	1	.....	1	1	1	1	1	1 p. share	2	1	1	1	1	Number of field circuits in parallel
0.199	.....	0.171	....	0.55—25°	1.6	0.8	3.5	0.825	0.5 each	3.06	0.7	1.7	.....	.....	Resistance of field circuit, ohms (warm)
.....	.....	.....	....	7500	1817.5	.....	3000	1470	.....	.....	2100	1650	... .	3100	Weight of copper in field, kgms
.....	.....	.....	....	54000	45000	18000	50000	....	.....	35000	20200	10200	.....	26000	Weight of field complete, without shaft
															ARMATURE.
.....	.....	4	3.5	6	5	7	6.5	7	5	7	10	6	6	11	Air-gap, mm
.....	150	220	130	640	570	355.4	551.5	500	220	600	600	450	126	540	Diameter of armature at air-gap, cm
.....	15	16.5	22.5	19	9	17.8	22	17	20.5	22.5	20	....	... ...	20	Radial depth of laminations, cm
.....	54	15.4	18.5	22	40	39.6	30	25	60	27	23	.... ..	.....	40	Useful length of armature, cm
....	220	297	170	792	672	463	680	632	309	740	726.5	505	.....	690	External diameter of armature frame, cm
.. ..	109	109	82	115	72	102	128	63	110	70	64	56	..... .	120	Total width of armature frame, cm
slots	rect. slots half closed	slots	slots	slots half closed	oblong tunnels	slots	slots	oblong tunnels	slots half closed	slots half closed	oblong tunnels	slots half closed	circular tunnels	slots	Kind of perforations
6 per pole	4	6 per pole 4 used	6 per pole	6	6	3	2 per pole	3	6	6	6	6	3—2 used	6	Number of perforations per pole
coils	coils	coils	coils	coils	coils	coils	coils	coils	coils	coils	coils	coils	coils	coils	Kind of armature winding
24	16	48	.....	41	72	20	64	32	12	38	32	32	14	20	Number of coils or bars per phase
series	series	2 series of 24 coils in parallel	.....	series	series	series	series	series	series	series	series	series	series	series	Grouping of coils of each phase
33	.....	30	.. ..	12	5	25	10	7	12	5	6	..... .	156	20	Number of turns per coil
33	.....	30	.....	6	5	25	20	7	6	2.5	3	.....	156	10	Number of conductors per perforation
2 wires of 3.2 *mm.* in parallel	.....	2 wires of 2.5 *mm.* in parallel	....	cable 19 wires of 1.6*mm.*	2 cables of 20 *mm.* in parl'l	rect. cable 5.8x12*mm*	ribbon 38x 3.5 *mm.*	cable	ribbon	wires of 3.9 *mm.* in parl'l	2 cables of 25 *mm.* in parl'l	.....	wire 1.6 *mm.*	ribbon 25x3 *mm.*	Kind of armature conductors
16.1	.....	19.3	.....	38	40	.....	133	65.4	.....	47.8	50	29	2 *mm.*	75	Section of armature conductors, square mm.
1.37	.....	0.253	. .....	0.34 — 20°	0.3	0.34	0.113	0.1	....	0.0778	0.13	0.33	.30	.....	Resistance of armature per phase, ohms (warm)
. .....	.....	.....	.....	.....	715	... .	.....	590	....	.....	500	540	91	1900	Weight of copper in armature, kgms
.....	.....	.....	.....	34000	17700	20000	60000	....	.....	33500	20000	15000	.....	34000	Weight of armature, with or without foundation plates, kgms
															TESTS.
56	17.3	63.5	.....	140	100.5	110	33	90	140	55	127.5	40	.....	140	No-load exciting current
31	6	50	.....	57	40	57	19	38	97	15	36	13.5	.....	52	Exciting current for normal current on short circuit
... .	... .	p. 275 *Kw* =75	.....	p. 1120 *Kw* =160	113	126	....	....	....	.....	141	45	.....	..... .	Full-load exciting current { *cos* ϕ = 1. / *cos* ϕ = min'm
p. 480 *Kw* =80	.....	p. 300 *Kw* =120	.....	230	153	.....	.....	.....	.....	.....	168	.....	.....	200	
.. ..	.....	275 *Kw* =8.6	.....	11.20 *Kw* =4	4 p	10 p	.....	.....	.....	.....	5 p	5.5	.....	70	Full-load drop, per cent { *cos* ϕ = 1 / *cos* ϕ = minimum
480 *Kw* =19	....	300 *Kw* =26	.....	13.7	9.8	.....	.....	.....	.....	....	12 p	.....	..... .	20	
24300 with friction	.....	20000 with friction	.....	.....	27000	19700	.....	.....	....	.....	.....	.....	.....	18000	No-load losses (hysteresis, eddy currents, ventilation)
.....	..... .	..... .	... .	28000	17200	13700	9100	.....	....	10300	5200	7500	.....	12600	Copper losses, watts
....	.....	p. 275 *Kw* =910	.....	1120 *Kw* =15600	20500	12700	.....	.....	.....	.....	14000	3450	.....	13200	Full-load losses, watts { *cos* ϕ = 1 / *cos* ϕ = minimum
p. 480 *Kw* =1280	.....	p. 300 *Kw* =2450	.....	32500	37500	..... .	....	.....	.....	.....	19800	.....	... .	.....	
....	.....	91.5	. .....	.....	94.8	95.6	.....	.....	.....	.....	.....	.....	.....	96.4	Efficiency, per cent, { *cos* ϕ = 1 / *cos* ϕ = minimum
93	.....	92	.....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

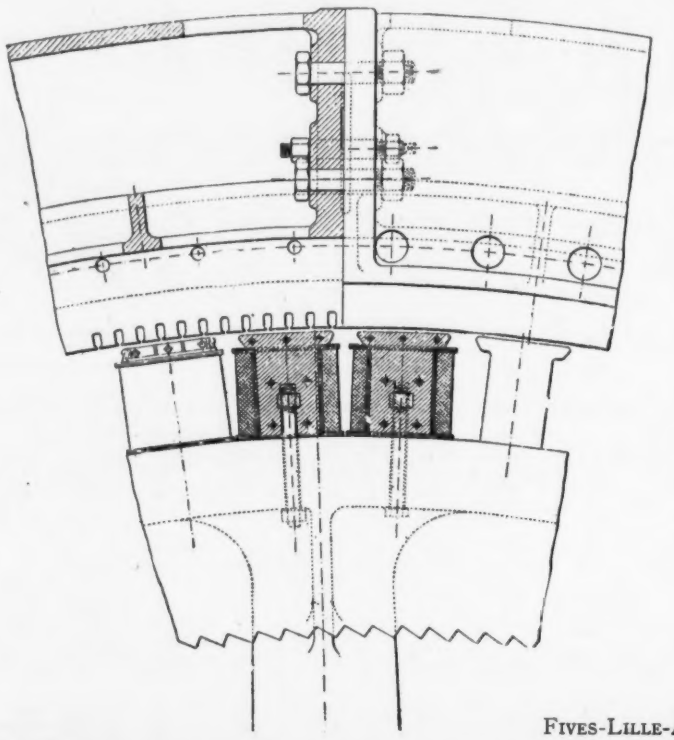


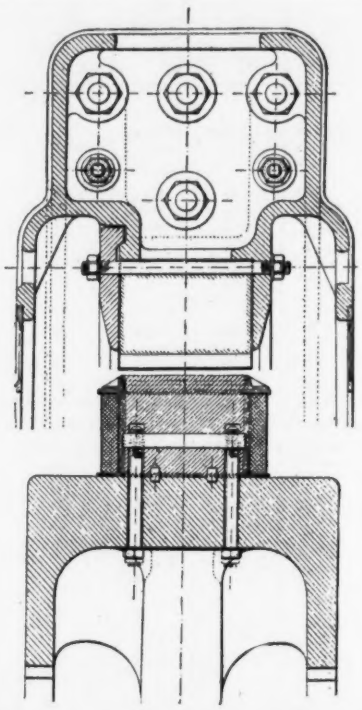
SCHEME OF ARMATURE WINDING FIVES-LILLE ALTERNATOR.



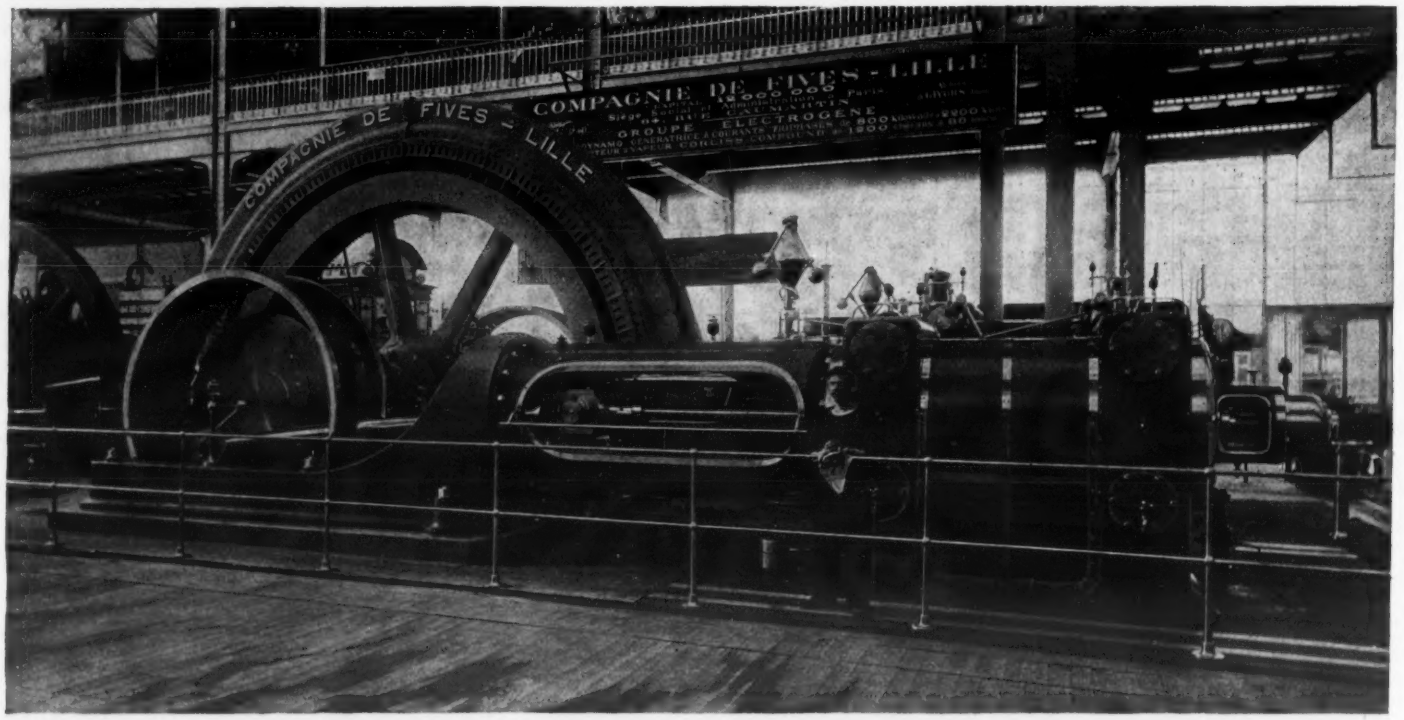
I.—No-load Characteristic. II.—Short-circuit Characteristic. III.—Excitation line.

CHARACTERISTICS OF FIVES-LILLE ALTERNATOR.





FIVES-LILLE-ALTERNATOR.



FIGS. 67 TO 71.—GENERAL VIEW FIVES-LILLE ALTERNATOR.

Elements of Illumination.—XXI

By Dr. Louis Bell.

By far the most complete study of the properties of the enclosed type of arc lamps is that recently made by a committee of the National Electric Light Association. The investigation was upon the arc lamps both for direct and alternating currents, as customarily used on constant-potential circuits. The results of the work, however, are not materially different, so far as distribution of light goes, from those that belong to similar lamps for series circuits. Fig. 5 of article XX. is the composite curve of distribution obtained by this committee in the tests of direct-current lamps. The individual curves vary somewhat, although showing the same essential characteristics. Fig. 1 shows a typical example both with the outer globe opalescent like the inner globe and also with a clear outer globe. The effect of the former in reducing and also in diffusing the light is very conspicuous. The opalescent globe absorbed a little over 14 per cent of the light. This absorption is much less than would be given by a ground or milky glass shade, but it serves to cut down the intrinsic brilliancy to a useful degree. A clear globe absorbs about 10 per cent, so the total absorption of the opal globe is about one-fourth.

The weak point of such lamps as efficient illuminants lies in the large amount of energy wasted in the lamp mechanism, including the resistance for reducing the voltage of the mains to that desirable for the enclosed arc. This loss amounts ordinarily to nearly 30 per cent of the total energy supplied, so that while the arc itself is highly efficient, the lamps as used are wasteful. No one but an American would think of working a 75-volt arc off a 120-volt circuit and absorbing the difference in an energy-wasting resistance, but the advantages of the enclosed arc are so great in point of steadiness and moderate cost of labor, that the practice has been found commercially advantageous, and the open arc has been practically driven from the field for all indoor illumination, and is being rapidly displaced for street lighting.

Foreign practice tends, as already noted, toward the use of two or even three open arcs in series on constant potential circuits. These can be fitted with diffusing globes to keep the intrinsic brilliancy within bounds, and obviously give a far larger amount of light for the energy consumed than is obtained here with enclosed arcs, but we have neither cheap high-grade carbons nor cheap labor, and as in the last resort the thing which determines current practice must be the total cost of light per candle-hour, it is likely that both methods are right when judged by their respective conditions.

At present alternating-current arc lights are being rather widely used, both on constant potential and on constant-current circuits, and such arcs present some very interesting characteristics. Evidently when an arc is formed with an alternating current there is no "positive" and no "negative" carbon, each carbon being positive and negative alternately, and changing from one to the other about 7200 times per minute, 120 times per second.

Under these circumstances no marked crater is formed on either carbon, and the two carbons are consumed at about an equal rate. As a natural result of the intermittent supply of energy and the lack of a localized crater the average carbon temperature is probably somewhat lower than in case of the direct-current arc and the real efficiency of the arc as an illuminant is also somewhat lowered. Tests made to determine this difference of efficiency have given somewhat varied results, but it seems probable that for unit energy actually applied to the arc itself the direct-current arc will give somewhere about 25 per cent more light than the alternating-current arc. But since when working the latter on a constant potential circuit the surplus voltage can be taken up in a reactive coil which wastes very little energy instead of by a dead resistance, which wastes much, the two classes of arcs stand upon a more even footing than these figures indicate. This comparison assumes enclosed arcs in each case, in accordance with present practice.

For street lighting, as we shall presently see, the alternating arc has certain advantages of considerable moment with respect to distribution, so that as practical illuminants they are often preferred.

The chief objection to the alternating-current arc has been the singing noise produced by it. This is partly due to the vibration produced in the lamp mechanism and partly to the pulsations impressed directly on the air by the oscillatory action in the arc itself. The former can be in great measure checked by proper design and manufacture, but the noise due directly to the arc is much more difficult to suppress.

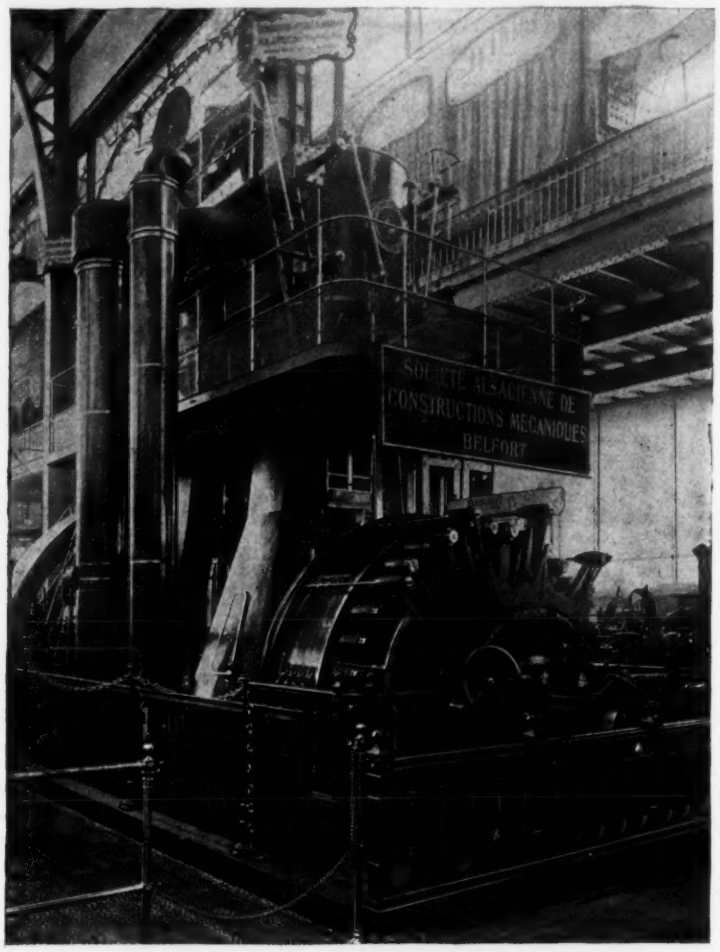


FIG. 72.—SOCIÉTÉ ALSACIENNE ALTERNATOR. (See page 398.)

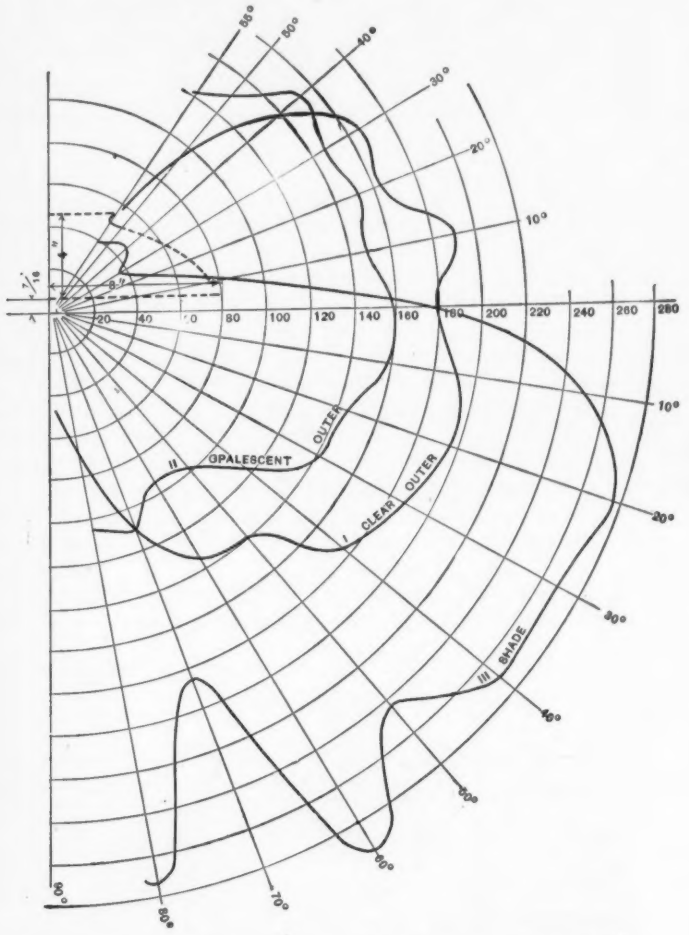


FIG. 1.—DISTRIBUTION OF LIGHT FROM DIRECT-CURRENT LAMP.

Abroad where, for the reason already adduced, open arcs are commonly used, a specially fine, soft carbon is used for the alternating arcs, and the noise is hardly perceptible. These soft volatile carbons, particularly when used at a considerable current density, give such a mass of vapor in the arc as to endow it with added stability and to muffle the vibration to a very marked degree. The result is a quiet, steady, brilliant arc of most excellent illuminating power. But in this country such carbons are with difficulty obtainable, and even if they were to be had at a reasonable price could not be used in enclosed arc lamps on account of rapid smutting of the inner globe. Hence it is by no means easy to get a quiet alternating arc, and in a quiet interior there is generally a very perceptible singing pitched a shade over a semi-tone below bass C with noticeable harmonics, a kind of chorus not always desirable.

In selecting alternating-current lamps for indoor work great care should be exercised to get a quiet lamp. Some of the American lamps when fitted with tight outer globes and worked with a rather large current are entirely unobjectionable, but in many cases there is noise in the mechanism or the globe serves as a resonator. With a current of 7 to 7.5 amperes and a well fitted and non-resonant globe, little trouble is likely to be experienced. Out of doors, of course, a little noise does not matter.

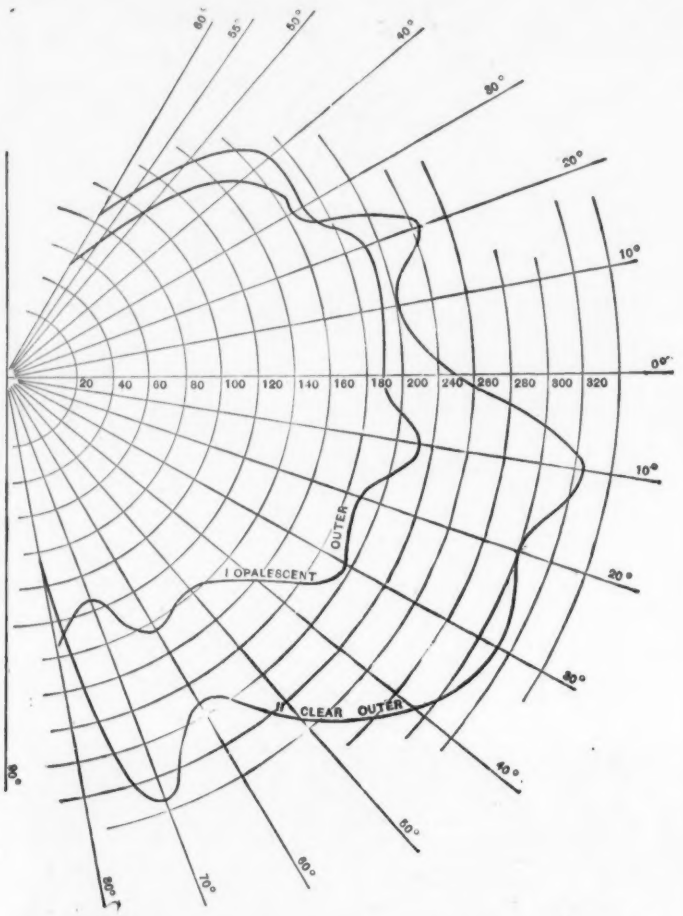


FIG. 2.—DISTRIBUTION OF LIGHT FROM ALTERNATING-CURRENT LAMP.

The chief characteristic of the alternating arc, as regards distribution of light, is its tendency to throw its light outwards rather than downwards like the direct-current arc; in fact, considerable light is thrown above the horizontal, which materially aids diffusion.

For this reason it is often advantageous to use reflecting shades for such lamps so as to throw the light out nearly horizontally when exterior lighting is being done. Indoors, diffusion answers the same purpose unless powerful downward light is needed, when the reflector is of service.

Fig. 2, from the before-mentioned report, shows the distribution of light from an alternating-current lamp, with an opalescent outer globe, with a clear outer globe and with no outer globe and a porcelain reflecting shade of the form indicated by the dotted lines in the figure. The abolition of the outer globe and the use of the reflector produces a prodigious effect in strengthening the illumination in the lower hemisphere, and this hemispherical illumination is for some purposes a convenient way of reckoning the illumination of the lamp. But a finer test is the spherical candle-power, since that takes account of all the light delivered by the lamp. Alternating arc lamps seem to work best at a frequency of 50 to 60 cycles per second. Above 60 cycles they are apt to become noisy and below about 40 cycles the light flickers to a troublesome extent. The light of the alternating arc is really of a pulsatory character, owing to the alternations. A pencil rapidly moved to and fro in the light of such an arc shows a number of images—one for each pulsation, and this effect would be very distressing if one had to view moving objects like quick running machinery by such light. A tale is told of a certain theater in which alternating arcs were installed for some gorgeous spectacular effects and of the extraordinary centipedal results when the ballet came on.

This pulsation is somewhat masked when the enclosed arc is used even with a clear outer globe, and is generally inconspicuous when an opal outer globe is used. It is also reduced when a fairly heavy current (7 to 8 amperes) is used, and when very soft carbons are employed, as they can be in open arcs.

An interesting comparison of direct current and alternating-current enclosed arcs, as used on constant potential circuits, is found in the following table, from the report already quoted:

D. C. Lamp.	Current.	Watts Consumed. In Lamp.	Watts Consumed. In Arc.	Watts Consumed. Mechanism.	Mean Intensity in H. U. Spherical. Op. Outer	Mean Intensity in H. U. Spherical. Clear Outer	Mean Intensity in H. U. Lower Hemispherical. Clear Outer	Mean Watts. Spherical H. U. Op. Outer	Mean Watts. Spherical H. U. Clear Outer	Mean Watts. Lower Hemispherical. Clear Outer
1	5.01	551	401	150	172	235	332		2.37	1.66
3	5.08	559	406	152	195	256*	362*	3.10	2.18*	1.52*
4	4.76	524	381	143	127	216	282	2.85	2.60	1.99
5	4.16†	458	333	125	154	139	208	4.12	3.76	2.52
7	4.76	524	381	143	203	174	221	2.96	2.63	2.07
9	4.84	532	387	145	182	333	317	2.63	2.20	1.65
10	4.99	549	399	150	202	226	281	2.83	2.38	1.89
12	4.87	536	390	146	178	242	309	2.74	2.24	1.77
Mean	4.9	529	384	144	176	195	230	3.05	2.66	2.33
A. C. Lamp.			**Power Factor Lamp.**		**Power Factor Arc.**					
101	6.40	448	.63	340	.82	108	127	141	206	352	317	2.17
								203	236		226	1.94
102	6.79	459	.61	375	.73	84	146	176†	266†	3.31	260†	1.72†
103	5.89	424	.65	344	.75	80	116	130	147	3.66	3.15	2.88
105	6.20	414	.61	382	.80	32	128	187	219	3.24	2.20	1.89
								153	169		2.56	2.23
106	6.12	378	.56	298	.70	80	132	152†	254†	2.82	2.49†	1.48†
108	6.48	457	.64	383	.80	74.5	133	175	211	3.30	2.61	2.16
110	6.18	339	.49	276	.72	63	140*	126	143	2.41*	2.68	2.37
Mean	6.29	417	.60	342	.76	74.5	130	159	190	3.31	2.66	2.23

* Condition of no outer globe. † Condition with shade on lamp.

NOTE.—All marked values not included in the mean.

It must be remembered that the results are in Hefner-Alteneck units. This unit is roughly 0.9 cp, so that the mean results reduced to a candle-power basis are for efficiency when using clear outer globes, as follows:

Direct-current arc ..... 2.89 watts per cp.
Alternating arc ..... 2.96 watts per cp.

These efficiencies are on their face but little better than those obtained from incandescent lamps. There is little doubt that as a matter of pure efficiency a given amount of energy applied to 3-watt incandescent lamps will give more illumination than if used in arcs of the types here shown. The incandescents lose a little in efficiency, but gain by the fact of their distribution.

But for many purposes the arcs are preferable on account of their whiter light, and the very brilliant illumination that is obtainable near them.

Both direct and alternating-current enclosed arcs gain by the use of rather large currents both in steadiness and in efficiency, and moreover give a whiter light. The same is true, for that matter, of open arcs in which the larger the current the higher the efficiency. Very many experiments on the efficiency of open arcs have been made with moderately concordant results. Their efficiency ranges in direct-current arcs from about 1.25 watts per candle in the smallest to about 0.6 or a little less in the most powerful. A considerable number of results by different experimenters have been consolidated into a curve giving the relation between current and efficiency, as based on mean spherical candle-power.

The data for forming a similar curve for alternating arcs are not available, but there is in this case the same sort of relation between current and efficiency as that just noted. There is generally accounted to be from 15 to 25 per cent difference in absolute efficiency in favor of the continuous-current arc.

Obviously the open arc has a greatly higher efficiency than the enclosed form, but the very great intrinsic brilliancy of the former is from the standpoint of practical illumination a most serious drawback. For all indoor use and for much outdoor use the open arc must be shielded by a diffusing globe, which to be effective should cut off about 25 per cent of the light. Taking this into account the working efficiency of the open arc in the sizes generally used is likely to range between 1.25 and 1.50 watts per candle-power. It cannot, however, be made a satisfactory illuminant upon any terms until better carbons are used than are now available at a reasonable price in this country.

Recently some very interesting experiments have been tried abroad with carbons impregnated with certain metallic salts. These composite carbons have given extraordinary efficiency, down to less than 0.5 watt per spherical candle-power, and give a light softer and less brilliantly white than usual. The product has not yet, however, been brought into commercial form, so that it is too early to speak with certainty regarding its merits.

We may now form some idea of the relative efficiency of different classes of arc lights. The annexed table puts the facts in convenient form for reference:

Kind of Arc.	Watts per Sph. c. p.	Remarks.
Direct current, open	1.0	Medium power arc.
Direct current, shaded	1.3	Medium power arc.
Alternating current, open	1.7	Approximate.
Alternating current, shaded	2.2	Approximate.
Direct current, enclosed	2.4	No outer globe. (Constant Potential.)
Direct current, enclosed	2.9	Clear outer globe. (Constant Potential.)
Direct current, enclosed	3.3	Opal outer globe. (Constant Potential.)
Alternating current, enclosed	3.0	Clear outer globe. (Constant Potential.)
Alternating current, enclosed	3.6	Opal outer globe. (Constant Potential.)
Alternating current, enclosed	2.5	No outer globe. (Constant Potential.)
Direct current, enclosed	1.9	Series lamp, approximate.

In watts per horizontal candle-power the enclosed arcs particularly the alternating ones do relatively much better than is indicated in the table. And in comparing arcs with incandescents it must be remembered that the latter when rated like the above arcs on mean spherical candle-power will not do much better than 4 to 4.5 watts per candle. But it is suitability to the work in hand that must determine the use of one or the other illuminant.

Bell Telephone of Canada.

The annual meeting of the Bell Telephone Company was held at Montreal on Feb. 28. The item of particular interest in the annual report was the fact of an increase of capital from $5,000,000 to $10,000,000 is contemplated. The present capital has all been issued and additional money is required for construction and general extensions. An additional bond issue of $2,550,000 has also been authorized, and these bonds will be placed upon the market as the funds are required. The annual report, which was read and approved, contained the following interesting points: Three thousand, four hundred and thirty-seven subscribers have been added during the year, the total number of sets of instruments now earning rental being 38,360; the company owns and operates 343 exchanges and 494 agencies; about 2430 miles of wire have been added to the long-distance system in 1900; the long-distance lines now owned and operated by the company comprise 21,350 miles of wire on 6525 miles of poles. There were $190,000 of 5 per cent bonds sold during the year, the net premium on which was $18,775, and 500 shares of stock were also sold at a net premium of $35,105. These premiums, aggregating $53,880, have been carried to the contingent account. There have also been $46,119 carried from revenue to contingent, making this account $900,000; $32,898 to the insurance reserve account, making it $100,000, and $50,000 written off the plant and patent account. The entire capital stock having now been issued and funds for construction being required, the shareholders at a special meeting held on Dec. 5 last, authorized application to Dominion Parliament for power to increase the capital fom $5,000,000 to $10,000,000, and the petition will be presented in due course. The gross revenue for the year was $1,614,262, and the expenses were $1,229,977, leaving a net income of $384,285.

Italian Turbines for a Canadian Power Plant.

BY GUIDO SEMENZA.

The Hamilton, Ont., Electric Light & Cataract Power Company has just put in operation an installation at St. Catherines, Ont., that presents this novel feature, that the turbines come from Italy. It was a question of installing two 3000-hp turbines under 255 ft. of

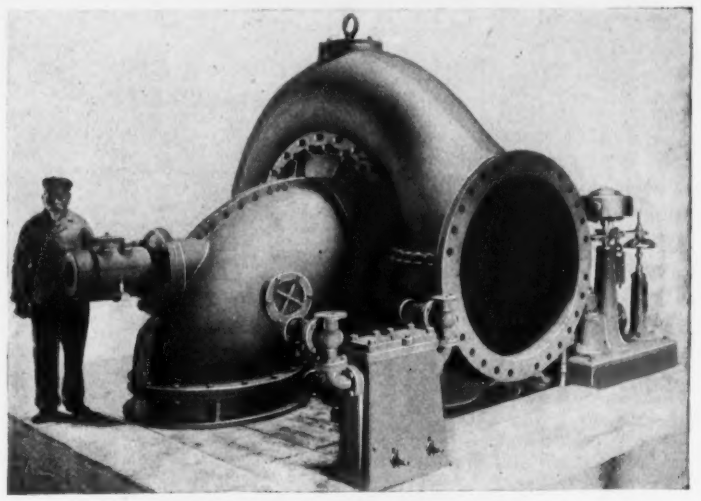


FIG. 1.—ITALIAN TURBINE.

fall, and as the firms on this continent did not have a wheel answering these data in their practice, it was decided to invite tenders from turbine builders in Europe. Mr. W. Kennedy visited the principal turbine builders of Switzerland, Austria and Italy, and placed the order with Riva Monneret & Co., of Milan, who constructed the turbines for the Paderno plant, where they have made a great success.

The accompanying cuts give an idea of the principal features of these wheels and of the governor. The speed is 286 revolutions. This fact explains why they have such small dimensions with so large power developed. The wheels are of the Francis reaction type with horizontal shaft. The shaft is located 15 ft. over the discharge level so that the wheel works under draft. The regulation is effected by a ring interposed between the distributor and the revolving part. This ring by slight rotation screens more or less the inlet of the water.

The revolving wheel and the regulating ring are made of hard bronze. The wheel is so arranged with a hydraulic counterpoise

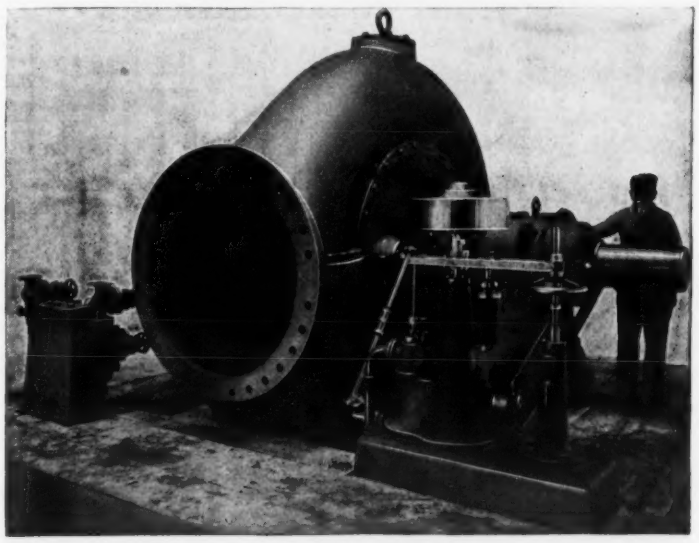


FIG. 2.—VIEW OF TURBINE GOVERNOR.

that all axial pressure on the shaft and therefore on all ring bearings is avoided. The governor works on the regulating ring by hydraulic pressure, filtered water being used for this purpose.

These turbines are the most powerful constructed up to date in Europe. Mr. W. Kennedy wrote about them as follows: "The limiting conditions imposed by the small available space, the power and speed of the turbines, the location of inlet and discharge pipes, etc., and the comparatively short time for the completion of the whole

work contracted for, demanded superior skill in the preparation of the design and also in the construction, and I am pleased to say that in my opinion the whole has been accomplished so successfully and completely as to reflect great credit on Messrs. Riva Monneret & Co., as constructing engineers for hydraulic machinery of any capacity." And later on he published his opinion on the practical results, saying: "I feel satisfied that the results obtained in design, cost and efficiency justified the placing of the contract as was done."

Ferranti Alternating-Current Generating Unit.

The accompanying illustrations show a type of generating unit now being constructed at the Ferranti Works, Hollinwood, England. The half-tone illustration shows a 1200-kw machine of the revolving armature type as installed at the South London Electric Supply Corporation. The line drawing is a general arrangement in front and side elevation of a smaller machine of the same type, the capacity being 800 kw and the revolutions 167 r. p. m. From these illustrations a good idea may be obtained of the compactness of the combined Ferranti engine and alternator.

The Ferranti engines are almost exlusively of the vertical compound type, running at medium speeds, and they have several special features, particularly as regards the valve-gear. The object which it has been endeavored to attain has been the economy of Corliss engines, combined with the possibility of much higher speeds; the advantage of high speed being to reduce the floor space occupied, to give more even turning moment, and to reduce the cost of the dynamo and engine. To obtain the economy of Corliss engines the system of four valves per cylinder has been adopted, and these valves are placed in the covers so as to minimize clearance surfaces and spaces. The valves are of the grid-iron type, and have a very short movement, and, as the valve-gear is only worked at half the speed of the engine, the surface speed of the valve faces is very low, consequently making the wear and tear low.

The valves are actuated directly from cams, the cams being so designed as to give a constant distance between the cam rollers, thus making it possible to work with fixed rollers, and making the motion quite independent of springs. This gives quite a positive motion. The cams are arranged on vertical shafts working in a completely inclosed box, which, by reference to the cuts, will be seen to stand midway between the cylinders. This box is filled with oil, consequently the whole of the valve-gear works absolutely immersed in oil. This is thought to have a very important bearing on the satisfactory working of the cam gears, and further, it leaves no part of the valve-gear to be oiled by the engine attendant. The connection between the cam and the valve is a direct one, thus there are no joints to wear, and the external valve-gear is extremely simple. The cam shafts are driven by means of cut gearing from the crankshaft, and each wheel is arranged to run in an inclosed casing containing oil, eliminating in this way any question of perfect lubrication. The governor can be either arranged to vary the cut-off automatically, or to act on the throttle valve, in which latter case the cut-off can be made either adjustable by hand or fixed.

Turning to the main parts of the engine, it may be said that these are, on the whole, of ordinary construction, similar to those usually adopted in marine practice, except that the crank-pin bearing is of the spherical type, so as to insure equality of pressure along the pin. The main bearing steps rest in spherical seats with the same object.

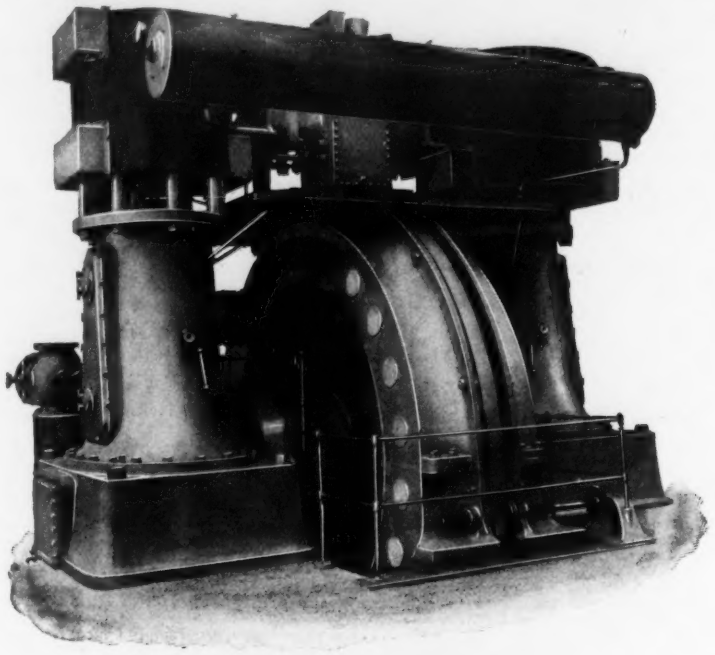


FIG. 2.—ALTERNATING-CURRENT GENERATING UNIT.

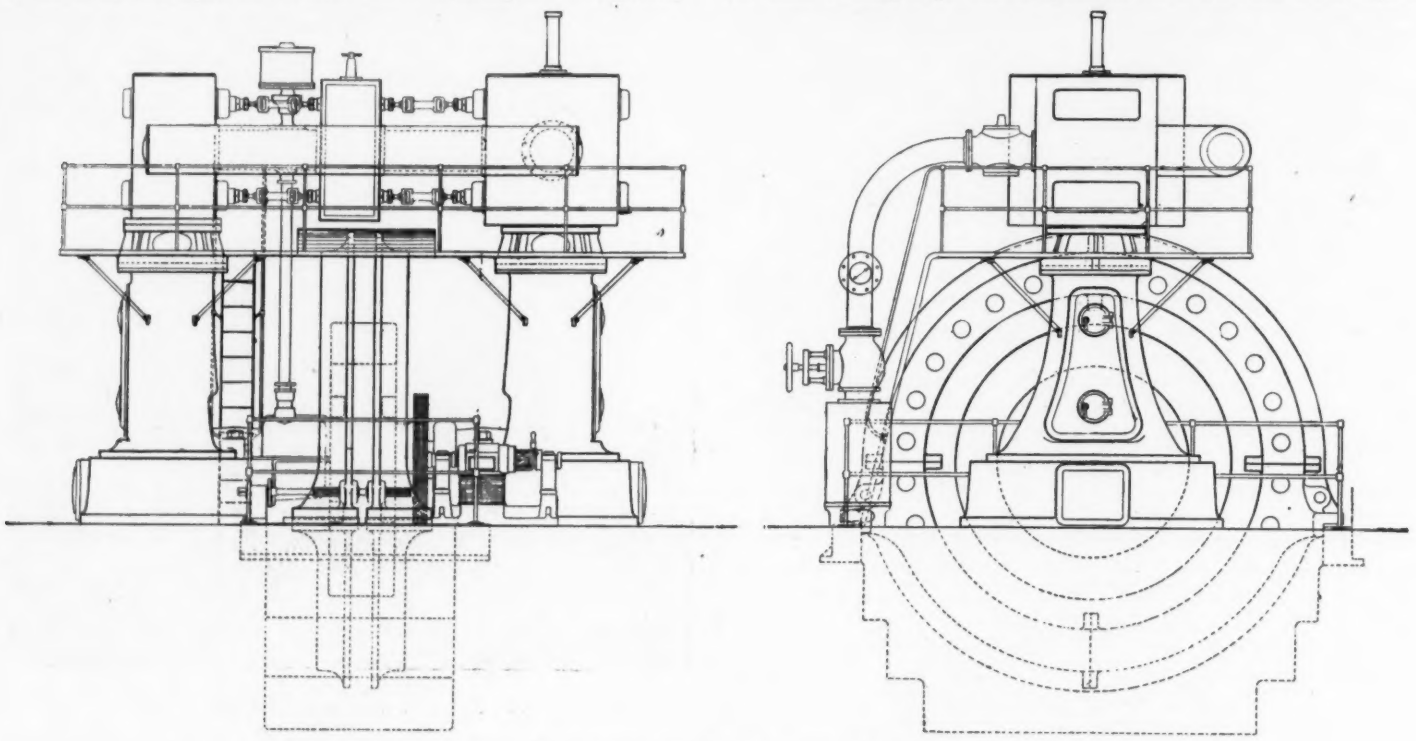


FIG. 1.—END AND SIDE ELEVATIONS OF ALTERNATING-CURRENT GENERATING UNIT.

The reciprocating parts are very thoroughly inclosed so as to prevent the slightest splash or leakage of oil, and, in proof of the effectiveness of the designs in this direction, it is stated that an engine has been running in the company's shops for over six weeks, not a pint of oil having been added, except for the cylinders.

A forced lubrication system has been adopted and the pumps made of ample capacity to give sufficient pressure after the engine has

run a considerable time, and, in consequence, worn the bearings rather slack. This removes the necessity for frequent adjustment of bearings, which is experienced if the oil pump is small. The oil is forced from the pump through a very effective filter, which is arranged in the engine bed-plate; the door of this filter will be seen in the engravings. From the filter the oil passes to the various bearings, from which it falls into the bed-plate through a strainer at the bottom of the bed-plate into a tank below. Thence it is again pumped through the filter to the bearings. To prevent the oil creeping along the crankshaft, oil throwers are arranged in series, it being believed that the only effective way to prevent creeping of the oil is to see that the last thrower has only to deal with such small quantities of oil as may have escaped past the preceding ones. In connection with electrical work the matter of keeping oil away from the dynamo is of the utmost importance, quite apart from the point of view of cleanliness and avoidance of waste. It is further to be remembered that oil damages concrete foundations.

Switchboard Connections for Standardizing Ammeters.

BY THEODORE W. FRECT, JR.

In years gone by the accuracy of switchboard instruments was given little if any attention, owing probably to the fact that the instruments of the past were unreliable at the best. As the development of electrical measuring apparatus has gradually been brought to its present stage, so the requirements of the station management have become more rigid. At present the user who was formerly satisfied to regulate the e. m. f. of his plant with a worn-out incandescent lamp and the distribution of current on his several dynamos according to the apparent load on engines, spends a great deal of time wondering whether the accuracy of his voltmeters and ammeters are strictly within the guarantee of the manufacturer, and in many instances unjustly condemns his instrument through some little irregularity which he thinks he has discovered. And yet with these requirements which are so essential in determining the efficiency of the plant and maintaining it, the switchboard designers do not seem to have taken any steps to provide for the convenience of occasionally checking the ammeters.

This could easily be done by providing a break in the circuit of each machine which, under ordinary conditions, could be closed with a suitable movable connection. When a check is desired, this connecting bar could be replaced with a shunt similar to the one used with the dynamo ammeter. If the dynamos were of different capacity, as is often the case, the station superintendent could have a number of shunts to correspond with the different ranges of his ammeters. All of these shunts could readily be adjusted to one instrument, and would prove sufficiently portable to be sent to a standardizing laboratory occasionally for correction. This arrangement would not only prove very satisfactory for determining the condition of the switchboard ammeters, but would be of inestimable value for temporarily replacing an instrument which it is found necessary to send away for repairs. Of course, a standard voltmeter would also be essential, but it would not be necessary to make provision for placing it in circuit.

While it is possible to insert a standard shunt by fitting it with terminals to engage the blades of the dynamo switch or making connection at the dynamo itself, it is usually very inconvenient and subject to error on account of the lack of knowledge or experience on the part of the person making the test. With compound-wound machines it is necessary to place the standard shunt in the leg of the circuit occupied by the dynamo shunt, and if connections are made at the machine it will often be found that the standard will indicate the output of the machine plus the field current, while the dynamo instrument indicates the output only. These difficulties would be overcome if the switchboard designer would provide the necessary connections for each ammeter, preferably on the front of the board, for if properly made they would not mar its appearance and would be most accessible. The labor involved in these additional connections would not materially increase the cost of the board and would accomplish much to allay or confirm suspicion directed toward the ammeters, often saving a great deal in the way of charges for checking and transportation on instruments which were really in good condition, not to mention the trouble incident to removing them from the switchboard.

American Street Railway Association.

The executive committee of the American Street Railway Association met at the Murray Hill Hotel, New York, on Feb. 28, to make arrangements for the twentieth annual meeting of the Association, which will be held in New York City. The following named members were present: President Walton H. Holmes, Kansas City, Mo.; H. H. Vreeland, New York; N. H. Heft, Meriden, Conn.; John B. McClary, Birmingham, Ala.; G. W. Baumhoff, St. Louis; Frank L. Fuller, Philadelphia; John R. Graham, Boston, and T. C. Penington, Chicago. It was decided to hold the meeting on Wednesday, Thursday and Friday, Oct. 9, 10 and 11. There will be two sessions of the convention on each of the first two days, and the last day will be set aside for the inspection of exhibits. The banquet will be held in the evening of the last day, when the newly elected officers will be installed. Madison Square Garden has been leased from Oct. 6 to 13, and it is expected that the exhibit of street railway appliances will be on a very large scale. The meetings of the association will be held in the same building. Provision has also been made for the meetings at the same time of the Street Railway Accountants' Association of America. The usual charge of 10 cents per square foot for space in the exhibit hall will be made.

A new departure has been decided upon in the matter of the papers presented to the meeting. They are to be printed and advance copies sent to the members. They will be read at the meeting by title only. The president was authorized to select a speaker to open the discussion on each paper, and 30 minutes will be given to the consideration of each paper.

The following topics were selected, upon which papers are to be presented:

Street Railway; a Review of the Past and a Forecast of the Future.

The Adoption of Electric Signals on Suburban and Interurban Railways, Single or Double Track, and Their Economy of Operation.

The Value of Storage Batteries as Auxiliaries to Power Plants.

The Public, the Operator and the Company.

The Best Manner and Mode of Conducting the Return Circuit to the Power House.

The American Street Railway Association: The Purposes of Its Organization and the Benefits Accruing to Investors in and Operators of Street Railway Properties by Memebership Therein.

The Economies Resulting from the Use of Four Motors Instead of Two on Double-Motor Equipments.

The Best Form of Car for City Service; A Consideration of the Various Types of Car as to Size of Car and Arrangements of Seats, Including the Best Types of Brakes and Wheels.

Practical Results Obtained from Three-Phase Transmission and Rotary Transformers or Motor Generators in Transmitting Power on Railway Lines.

Relations of Interurban and City Railways.

The Modern Power House, Including the Use of Cooling Towers for Condensing Purposes.

The admission fee will be waived in the case of any company becoming a member of the association prior to Oct. 1 next, provided the annual dues to October next be paid at the time the application for membership is made.

The president appointed the following named gentlemen as a committee of five on Standardizing of Street Railway Equipment: J. R. Graham, Boston; N. H. Heft, Meriden; F. G. Jones, Memphis; W. J. Hield, Minneapolis, and C. F. Holmes, Kansas City. The committee is authorized to incur an expenditure not to exceed $1000. The president also appointed the following named gentlemen as a committee of three to report at the next convention on the subject of Transporting the Mails and Mail Carriers on Street Railway Cars: C. S. Sergeant, Boston; C. L. Rossiter, Brooklyn; J. B. Parsons, Philadelphia. It is confidently expected that the forthcoming meeting will be the most largely attended and of greater value from a practical standpoint than any that have been held. The executive committee was most pleasantly entertained by President Vreeland, of the Metropolitan Street Railway Company, during the stay of the members in the city. Mr. Vreeland counts confidently upon having all the important new work upon the Metropolitan system completed by the time of the October convention, so that then visitors will be able to see in full swing the largest street railway system in the world.

Three Important Electric Railway Patents Declared Invalid.

The United States Circuit Court of Appeals for the Second District in New York handed down decisions on Feb. 27 declaring invalid the Knight patent on the controller interlocking device, and on two Thomson electric blow-out patents. The Knight patent (No. 428,169), issued May 20, 1890, relates to electric railway controllers having a reverser and regulator manipulated by separate handles, in combination with a stop or lock so constructed and arranged as to leave both the reverser and the regulator free to be operated independently of each other. In order to reverse, however, the motorman is required not only to operate the reversing arm, but is compelled to bring the regulator back to its "off" position before the other can be moved, and conversely he cannot operate his regulating lever until his reversing lever has been removed from the "off" position to the one side or the other. The point involved in the litigation was whether Knight invented the locking arrangement whereby one device locks the other.

The Court held that the patent is in no sense a pioneer one. It did, however, add a new or locking feature to preceding devices in which the regulator and reverser were operated by different methods. The Court considers while this locking device was undoubtedly an improvement, it was not an invention of such novelty and importance in motor apparatus as to make a distinct step in the progress of the art as contrasted with mere improvement or perfection of what had gone before. Several interlocking devices of prior date and for other uses are described which, the Court stated, like those of the patent in suit, consist of two parallel shafts provided with handles and mounted side by side in a common frame and manually operated, and capable, except for the locking apparatus, of being simultaneously manipulated by the operator.

In view of the limitations imposed upon the claims of the patent in suit by the prior state of the art as thus illustrated, the Court considered that they ought not to receive a construction which will enable them to include a combination in which the several devices are not substantially described in the patent. It will not do to say that because the patentee was the first to introduce locking devices into a motor in which a regulator and reverser were operated by different levers, he is entitled to a monopoly of all locking devices in such a motor that will so co-ordinate the movements of two levers that neither will move except when the other is at a predetermined position. The patentee is entitled to the merit of being the first to conceive of the utility of interlocking two levers of a motor controller of a type in which the said levers are employed, but his right to the patent must rest on the novelty of the means he has devised to carry his idea into practical application.

The first four claims of the patent cover in the broadest terms the combination of any locking device with any parts of a two-lever controlling apparatus which will effect function or result in the claims, and the great scope of these broad claims were held not to be warranted by the scope of the real invention of Knight. Concerning the contention of the defendants in the suit that the device described in the fifth claim of the Knight patent is inoperative, the Court states that as it is not asserted by the complainant that infringement of the fifth claim has been established, it is unnecessary to advert to the difference between the devices employed by the defendant, and the patented devices. The Court declared that the first four claims of the patent are invalid, and in absence of any proof of infringement whatever of the fifth claim, the decree of the lower Court in favor of the complainant, is reversed.

Of the two Thomson patents, one (No. 233,167) was issued Aug. 14, 1883, and covered the magnetic blowout principle as applied to street railway controllers. The second patent (No. 401,085) was issued April 9, 1889, and related to the application of a shield of insulating material between the opposed surfaces of the arc-rupturing device and the electrodes between which the arc to be ruptured is formed, threby preventing an arc from forming at any other portion of the electrodes than is directly subjected to the arc rupturing force, and permitting a conducting material to be applied, without danger of defect of action, very closely to the electrodes.

Concerning the first patent the Court, referring to the early experiments of Davy and others, stated that the old scientists demonstrated that the magnetic field pulls the arc away from the electrodes and extinguishes it. Experts for the patentee admitting this, claimed that "it pulls so rapidly and scatters the arcs so widely that the contact surfaces are kept smooth and are not fused." The Court considered, however, that this new discovery of the preservative action upon the contact points is so much a part of the known result of the old law as not to deserve the name of a new discovery. The theory of the divisibility of the Davy discovery of the effect of a magnetic field upon a voltaic arc which burns, from the alleged discovery of Thomson of the effect of the magnetic field upon the ends of the conductor between which the arc is burning, is held not to be strong enough to bear the weight that the experts placed upon it. The Court concluded that if the patent was to be sustained it would rather rest in its support upon the declaration that Thomson applied the law which the scientists observed in laboratory experiments upon magnets and electric wires, to a switch of commercial use and efficiency and made the experiments of practical utility.

As to the second patent, the Court considers there is no doubt that the improvement caused by the insulation described has novelty in, and that it had not been used before the date of the invention upon arc-rupturing devices of the character mentioned in the patent; it was also useful in connection with other inventions of the same patentee, and by resulting in an automatic circuit breaker, it has been of great value. As to patentability, however, there was nothing new in the conception of the idea that the way to prevent lateral discharges between conductors was by the interposition of insulation. The fact that the insulation of the poles of the magnet allows very close approach to the electrodes and thereby enhances the intensity of the field, is a result which was incidental to the main object of the invention, for after insulation had stopped the danger of lateral discharges from electrodes, the magnet could then be pushed more closely to them. The Court concluded that it cannot perceive that the effect of the insulation in an arc-rupturing device was anything more than the old effect which had always accompanied insulation, and which was accomplished by the old mechanical means, although it was used to prevent lateral discharges in connection with an arc-rupturing device.

Electrical Developments in the British West Indies.

A cablegram has just been received from the British Colonial Government of the Island of Trinidad by Mr. W. B. Chapman, of Montreal, representing the Trinidad Electrical Company, which is composed of Montreal capitalists, stating that the Colonial Office has consented to the granting of a charter to the company for the construction of an electric tramway line and an electric lighting plant in the city of Port of Spain, the capital of the island. The Trinidad Electric Company some months ago obtained control of the existing tramway lines and lighting plant in Port of Spain, and made application for a charter to convert the tramway lines into electric trolley lines, covering the entire city. The charter also asked for power to extend the lighting plant to all parts of the city, and its adjacent suburbs. This application was dealt with by the Colonial Government of the island, and referred to the Imperial Government for ratification. This has been given, and the company now has a charter under which it proposes to expend some $940,000 in acquiring existing tramway and lighting plants and converting them into a system covering the whole of the city of Port of Spain and three adjacent suburbs. The new company, which will shortly meet for organization purposes and election of officers, will be capitalized at over $1,000,000, and the work of construction will be commenced in the course of a few months. Already Messrs. Bruce and McConnell, engineers in the employ of the new company, have gone over the ground and prepared plans and specifications of the work the company proposes to undertake. The existing plants, which the company will take over, include a good electric plant with a mile and a half of poor tram-line, and a small lighting system. There are also about 8 miles of good mule-car line in and outside the city. The Island of Trinidad is the most prosperous of all the British West Indies. There is reason to believe that resort will be had to the American market for much of the material required.

After an English Franchise.

A dispatch from London, Feb. 27, states that Mr. Tom L. Johnson, the American electric railway promoter, is seeking Parliamentary sanction for an electric railway from London to Brighton. This has been talked of before.

Views in the Telephone Industry as to the Berliner Decision.

The effect of the decision of Judge Brown in Boston last week declaring the Berliner microphone patent invalid, has naturally been the subject of much discussion in electrical circles and in the public press during the past week. As a general thing, officials of the Bell companies are reticent on the subject, and the counsel have given it to be understood that the decision will, of course, be appealed. Those who have spoken out, like President Tyler, of the Southern New England (Bell) Telephone Company, have said that they either did not consider the decision of any great importance, or that patents did not now play a leading part in the industry—it was a question of good service at fair rates. The patent, if sustained, would have run until 1908, but for the past few years all the independents, except a few under agreement to stay out of the business, have been busy installing systems all over the country, so that it is claimed there are now nearly 6000 exchanges, offices and small groups, with 1,500,000 subscribers, while the Bell interests claimed less than 700,000 stations in the last annual report. Judge J. M. Thomas, the president of the National Independent Telephone Association, when interviewed last week, as noted in these columns, expressed the belief that a great incubus had been lifted from the art, and that millions of new capital would now be poured into the independent exchanges for their development. He stated also that the Berliner suit was only one of a long series that had been won by the independents against the Bell Company, the total of such victories being put by him at 60. While this decision was expected, he said, a good deal of capital had been holding back until the Berliner patent was out of the way.

As might be expected, independents are very frank in the expression of their views on the situation, and we are able to give below interviews and authoritative statements from a large number of them.

The Farr Telephone & Construction Supply Company, of Chicago, C. W. Farr, president, says: "The last decision given by Judge Brown in the Berliner transmitter case will not cut much figure with the capital now invested in the independent telephone business throughout the United States. The capital now invested had already decided that the case would never be decided against it, and for that reason the men interested have pushed the independent telephone business in all parts of the country. More timid capitalists have been slow to invest their money with the independent telephone people of the country, fearing that the decision might be in favor of the Berliner patent, and in some localities it has been quite hard to raise money on independent telephone stock for this reason. We think the late decision will surely make a big boom for the independent companies throughout the United States, and that all classes of capital will now feel at liberty to invest their money in the enterprise. The Bell Company will probably keep up the bluff and have their agents inform all interested that they will carry the suit to a higher court, although we do not fear any bad results any more by this kind of talk from the Bell people. We are looking forward to a very heavy business in the telephone line the coming spring and summer."

The Lambert Schmidt Telephone Manufacturing Company, of New York, through its president, Mr. Schmidt, offers the following considerations: "The recent decision before Judge Brown in the United States Circuit Court declaring the Berliner microphone patent invalid is unquestionably of paramount value to the independent telephone business. It is a direct slap at the unreasonable claims of the Bell Company, and will be the means of a large increase in the development of independent exchanges. The independent manufacturers have always held that the Berliner claim was a false one, and that no right-minded judge could render a decision in favor of the Bell Company. The fact that a patent is considered lawful until declared otherwise in the United States Courts has been the only obstacle. This decision will furnish the independent manufacturers as well as the exchanges a new source of energy in raising competition against a monopoly that is without comparison anywhere. It is indeed hard to foretell the enormous advantage that will accrue from this decision, but it is certain that it will be a large one and will result very quickly in the favor of the independent industry. It also demonstrates that a so-called monopoly cannot operate independently in this country except on a fair and justifiable basis. This decision has been received by our company with considerable pleasure, and we feel that there is a bright future before us."

Mr. Elisha B. Seeley, manager of Couch & Seeley Company, leading telephone manufacturers in Boston, where the decision was given out, says: "There has never been any question in our minds as to the ultimate outcome of the Berliner case; nevertheless, we are cognizant of the fact that people having money to invest will more readily recognize the opportunity and desirability offered by this course of investment now that this old bugbear, which the Bell Company has never ceased to flaunt in our faces, is dead beyond the possibility of resuscitation, and to this extent telephone industry will be benefited by this decision."

Mr. J. A. Williams, president of the Williams Electric Company, of Cleveland, does not see much immediate effect: "I do not consider that the decision in the Berliner case, recently handed down, will make much difference in the status of the independent telephone business, as the vast majority of all the parties interested in exchange promotion, construction or operation have been practically certain, for the last two or three years, that the decision would be rendered just as it is. The only thing which it has done will be to remove the doubt which may have existed, in the minds of a few who contemplated engaging in the independent telephone business, and to this extent only will it affect future prosperity of the industry. Had this decision occurred three or four years sooner, the independent telephone business would no doubt to-day be much greater in extent than it now is. It, however, places independent telephone interests beyond the peradventure of a doubt, upon an absolutely safe commercial footing, and we may look for within the next four or five years unparalleled advancement and prosperity in the independent telephone interests. To the early investors in independent telephone exchanges a great deal of credit is due. They really were the pioneers in the field and performed their work and risked their means under what certainly must have seemed to them at that time risky conditions."

President G. A. Briggs, of the Chicago Telephone Supply Company, takes the following view of the situation: "In our opinion the decision of Judge Brown invalidating the Berliner patent will have a beneficial effect on the telephone trade. The Berliner microphone patent has been used by the Bell Company for years to intimidate users of independent apparatus everywhere. There is no question but what the threats of the octopus had great effect in deterring large numbers of people from becoming interested in independent telephony. The decision of Judge Brown is decisive on every point involved. It completely demolishes the claims of the Bell Company and confirms the contention of the independent interests that the Berliner patent was the last hope of organized greed to retain its hold on the pockets of the people. The most timid of purchasers will no longer have cause for apprehension and independent telephony will spread until there will not be a farmhouse, however isolated, which will not be provided with that modern necessity—telephone service."

Mr. E. B. Overshiner, president of the Swedish-American Telephone Company, of Chicago, makes the following remarks: "Once more the right and justice predominated and the decision rendered reveals the absurdity of the Berliner claims. The honor of the victory belongs to the many independent exchange owners, as Judge Brown no doubt took into consideration that if the Berliner claims were valid, then so many good business men would not have invested their money. This decision simply explodes another bugaboo claim held over the independents and the threats implied in same. The decision rendered was a surprise to no one except to those not posted. The Bell Company knew that they were fighting against a lost cause and were simply fighting for time, realizing that as long as the decision hung fire they had a certain amount of capital intimidated. That capital will now come forward and set a pace for the would-be monopoly that will compel it to adopt the independent method of doing business—'Live and let live.'"

The Holtzer-Cabot Electric Company, of Brookline, Mass., says in regard to the decision: "We believe that it will instill new confidence in those who are investing in independent telephone securities, and will doubtless assist greatly the undertaking of large telephone enterprises independent of the Bell Company. We believe, however, that there was very little fear of this particular patent; in fact, it seemed a forgone conclusion that it would be declared invalid, and it was rare indeed that the question of infringing this patent was ever considered when any telephone enterprise was on the tapis. If the decision had been in favor of the Bell Company it would have paralyzed the independent companies temporarily at least, but we do not believe it would have ultimately affected the development of that

field. Of course, there is the possibility of the case being brought to a higher court with the risk of a different opinion being handed down, but the decision of Judge Brown was so complete in refuting any claims of Berliner that no person is likely to fear any further action that might be taken."

The Central Telephone & Electric Company, of St. Louis, Mo., say: "We believe that the Berliner decision has been discounted by the independent telephone companies to a very great extent. Still the subject has been used for bluffing purposes by the Bell Telephone Company for quite awhile, and in many instances it has prevented capital from being invested in the independent telephone business. We do not look for any immediate increase from the effects of this decision, but believe that it will certainly add to the already large demand for independent telephone goods."

One of the largest independent telephone exchanges is that at Atlanta, Ga., employing the Clement-Gharky system. Mr. Edward E. Clement, the president and general manager of the Sun Electric Company, of Philadelphia, contributes the following interesting discussion of the decision and its effects: "In the matter of the Berliner patent, we beg to say that the protracted character of the proceedings has resulted in a rather general discount of the decision. That is to say, that the bugaboo has been in sight so long, its first effect has pretty well worn off. There has been, however, a lurking sense of uneasiness in the minds of all those who understood the action that would probably be taken by the Bell Company if the patent was sustained, and to them the decision comes as a relief. As regards investors in the independent field, they will doubtless be impressed by this clearing of the atmosphere, and this will help in the immediate growth of enterprises that would otherwise progress more slowly. Capital is more or less timid, and despite the statements of Bell leaders, that their company has relied for years upon purely commercial methods in competition, nevertheless the Berliner patent has been flaunted in a manner to obtain all the benefit possible from its flourishing. Speaking generally, the effect of this decision will doubtless be to strengthen and stimulate the independent movement all along the line, but to my mind the most important effect it has, and will have, is not confined to the telephone industry by any means. I refer to restoration of confidence to our patent laws, as administered by the courts, which must ever be beyond coercion or control by any individual or corporation, no matter how powerful. This patent was an iniquitous grant. It has depended for its existence purely and simply upon an artificial interpretation of a law, which is so important to the well-being of this country, that its administration should never be hampered by unnecessary adherence to mere technicalities. The very foundation of our whole patent system is the friendly agreement between the people through their governing officials, and the inventor, that he shall be ensured the exclusive right to the product of his brain and skill for a term of years, if at the expiration of that time it shall be free for all. There is here a fair concession on both sides. The public relinquishes the right to invent the same thing, as well as the right to make it or use it, without the inventor's permission, and the inventor limits himself to the stated period of 17 years in which to gather compensation for his labors. In the case of the telephone, the Bell Company long ago received all benefits in full that it was entitled to, as the assignee of its inventor, Mr. Bell, and its other inventors, Mr. Blake, Mr. Edison, et. al. Having established a questionable right in the beginning, the public acquiesced in that establishment, and waited patiently the expiration of the controlling patents. During this time specific patents on the microphone had had come and gone, lending their strength to the Bell Company, while they lasted. Then came the Berliner patent, having absolutely no moral reason for its existence, but purely and simply a technical reason, and through its agency this corporation, which had not only derived millions from the people, but had limited the use of the telephone by an iron rule to such territory as it could itself supply, and in future possibly control, essayed once more to put up the bars against public entrance to a field, where it had already maintained exclusive pasturage longer than the spirit of the law contemplated. Looked at in this light the decision cannot fail to have a wholesome effect in restoring confidence. Capital needs protection, but so do the people, and perfect laws are not so important as a perfect administration."

Mr. I. J. Kusel, of the Eureka Electric Company, of Chicago, makers of telephone instruments and switchboards, writes us as follows: "The fact that Judge Brown, in reviewing the decision in the case lays bare all of the weaknesses of the claims only proves conclusively that the opinion and strength of this patent was as maintained by knowing independent telephone men simply what it has always been claimed—great in notoriety only! There is no question that the Bell Company had hoped against the worst. Had they won, it would have only meant continued litigation in the higher courts. The decision is so sweeping and so clear that there can be no hope that we can see for the monopoly in the upper courts in the event that they should take an appeal. While the independent field has grown beyond the fondest hopes of its earliest promoters, we can only believe in the realization of the wildest imagination of success in store for the independent field, and the future movements of the monopoly along other lines will be watched with interest, for amusement's sake if for nothing else. That the independent field is in a most healthy condition, and that future prospects are certainly flattering is evidenced by the fact that all factories manufacturing high-grade apparatus have all that they can handle. The faith that independent manufacturers have maintained all along that the claims of this patent were worthless is further evidenced by the extent to which each and every plant has been extended from time to time, until now the telephone manufacturing industry may be classed along with any of the electrical branches."

We are indebted to Mr. W. E. Doolittle, general manager of the Sterling Electric Company, of Lafayette, Ind., for the subjoined expression of opinion: "The decision handed down by the United States Court in the Berliner patent case is the most important happening since the inauguration of the independent telephone field. The Berliner patent has always been held as a club, a bugbear and a menace over independent telephone manufacturers, operatives and prospective investors. With this decision against the patent, confidence will be established, manufacturers and operators will take hold with renewed vigor, but the most important effect will be the giving to independent properties a stability and firmness that will attract the attention of capital and will bring large amounts of new capital into the field for new enterprises. The independent telephone field since this favorable decision will show a growth and improvement with the year 1901 that will exceed the expectations of the most sanguine."

The Kokomo, Ind., Telephone & Electric Manufacturing Company says, under date of March 2: "We were not surprised at the decision; in fact, we expected it. We feel it will have a wholesome effect on the industry as it will remove a scarecrow that has hung over the business for several years past. New capital will take hold, and the independent telephone industry will grow as never before."

Our regular Cincinnati correspondent writes: "The recent decision of the United States Circuit Court at Boston in the matter of the Berliner transmitter patent, has aroused considerable comment among the independent telephone people of Ohio, which is said to be the largest field of the country, with Cincinnati as its principal point. Says one of the managers of one of the largest Ohio concerns: 'The decision will have little effect on the independent companies, as they are already using the transmitter. As to what will be done, it is said the sub-companies may refuse to pay royalty and buy out the transmitters. The principal obstacle to this scheme would be the fact that the Bell Company has possession of 51 per cent of the stock.' There is some curiosity as to whether the Bell Company will go into the retail sale of apparatus or deal with the public only through its 39 licensee companies as regular subscribers."

Mr. W. J. Barr, telephone apparatus manufacturer of Cleveland, says: "The Boston decision on the Berliner patent will no doubt increase investments in the independent telephone field and make the industry more substantial. However, it is hoped that any increase of business will not have the effect of decreasing or abandoning the experiments upon new principles and new construction."

Mr. J. D. Leatherbee, of the National Telephone Company, of Boston, who has been one of the most conspicuous figures in the litigation, is very reticent as to his part in it, and thinks that compliments are due rather to the lawyers who fought for the defense and secured a verdict. There has been a great deal of interest as to Mr. Leatherbee's plans for his company in the near future, now that an injunction no longer hangs over him, but he has so far refused to state what he proposes to do.

Mr. Philip S. Dorlon, of Troy, N. Y., who, it is said, is now likely to be active again in the field, remarks: "I believe that the Boston decision invalidating the Berliner microphone patent is an incident from which tremendous benefits will result to the whole country during the coming years. It is an auspicious event in the unfolding of the new century."

Mr. W. E. Russell, president of the Russell-Tomlinson Electric Company, Milford, Conn., writes us: "The recent decision against the Berliner patent we consider to be of the greatest value to the telephone industry, both to the independent field and to the Bell interests. While we have been very busy in the past, we now expect to be more so, and have, therefore, provided for a much larger increase in our output than would otherwise have been the case."

In an interview in the Washington *Star*, Hon. C. H. Duell, Commissioner of the United States Patent Office, is quoted as saying: "There will be no limit in long-distance telephony. And how cheap telephones will be! Washington merchants will have no cause to complain. Quadruplex machines will come and telephones at 10 cents a month will be about what to expect. It will be as easy to send four or five messages over a single wire by the telephone as it is with the telegraph now. Everybody will have a telephone. People will live longer, be happier and enjoy greater blessings."

Judge R. S. Taylor, of Fort Wayne, Ind., who conducted the defense for the independent companies, says: "The decision made in Boston is in two suits brought by the Bell Telephone Company against independent manufacturers of telephones upon a patent granted to Emile Berliner Nov. 17, 1891. The patent covers in the broadest terms what is known as the microphone, a form of telephone transmitter in universal use. It differs from the form of the transmitter invented by Bell and described in his patent of 1876, and in an improved form in his patent of 1877. The microphone was introduced into use as the invention of Thomas A. Edison in 1878. During that year an interference in the patent office, to which there were a great number of parties, disclosed the fact that Emile Berliner had in the office an application filed in June, 1877, in which could be perceived by the Bell Company's experts some suggestions which by suitable alteration and expansion could be made to cover the idea of the microphone. The Bell Company bought the application, changed it so as to make it describe the microphone, then kept it in the patent office until 1891, when it took out the present patent. I am advised by my associates that the opinion of the Court sustains the first, second, third, fourth and fifth defenses completely. Such a decision destroys the patent, root and branch."

Mr. C. A. Brown, the well-known patent lawyer of Chicago, formerly in the Western Electric Company, in an interview, said: "The decision of Judge Brown, following the decision of Judge Carpenter of the Circuit Court, will have the effect of relieving the apprehension of manufacturers and investors who are interested or likely to be interested in independent telephone enterprises on the score of any fundamental patent controlled by the American Bell Telephone Company at the present time, and will give a decided impetus to new telephone enterprises, so that it may be looked upon with certainty that there will be more development of the telephone industry in the immediate future than there has been even in the past."

Mr. J. A. Haines, president of the Haines & Noyes Company, of Chicago, writes us: "We might say that we believe that independent telephone manufacturers in the past have succeeded in inventing and manufacturing transmitters which were just as satisfactory as the Berliner transmitter, and did not encroach upon that patent. As the independent telephone field is growing rapidly, we see no reason why the fact that the Berliner patent has been declared invalid will in any way increase the telephone business. It is true that some manufacturers may make radical changes in their transmitters, but others, like ourselves, who manufacture transmitters without the use of felt or other moisture-absorbing material, will still continue making the same without regard to the invalid patents. The independent telephone manufacturers have succeeded in putting on the market apparatus equally as efficient as the Bell, and in many cases superior to it."

The Phœnix Electric Telephone Company, of New York City, say through President G. W. Sutton: "We believe the principal effect to be looked for from this decision is that the investing public and bankers generally will look with more favor upon the securities of independent telephone companies. Those conversant with the facts of the case have not lost much sleep on account of the Berliner patent, but investors generally are over-averse to putting money into a possible lawsuit, which has, to a considerable extent, hampered the independent company in receiving money to fight the monopoly. It is our opinion that prices to be derived from well-equipped independent telephone exchanges will now attract the investing public, and that honest enterprises of this character will no longer have difficulties in floating their securities."

Relative Efficiency of the Steam and Gas Engine.

In a paper read at the February meeting of the American Institute of Electrical Engineers, Mr. W. J. Hammer quoted the following from a letter written by Prof. R. H. Thurston in reply to a request for an opinion as to the relative efficiency of steam and gas engines:

The best work, to date, is practically the same for both engines. Each has delivered the net horse-power with a consumption equivalent to about 1 lb. of good coal. The consumption of such fuel for efficiency unity would be about one-fifth of a pound per horse-power, and these engines have thus both attained an efficiency, between the coal pile and the point of delivery, of about 20 per cent.

The steam engine has attained so nearly its limit that further progress under commercial conditions would seem to be likely to be hereafter very slow and to be dependent mainly upon the possibility of increasing the thermodynamic efficiency by extending the thermodynamic range of working temperatures. In the steam engine, this range may be increased either by still further increasing the working pressure at the boiler or by superheating the steam or by both expedients combined. Higher pressures are coming to be available, with progress in the construction of high pressure, presumably water-tube boilers, and we have, in Sibley College work, employed over a thousand pounds without special difficulty, and I have no doubt that we can quite as well, as did Perkins two generations ago, use pressures of 2000 lbs. and probably more. We are now beginning to find practical methods of construction and use of superheaters for ordinary pressures, and I have little doubt that we will be able to superheat steam of those higher pressures in course of time. These improvements should permit the increase of efficiencies by something like 50 per cent and bring the consumption of fuel down to three-fourths of a pound of good fuel per horse-power hour, and perhaps within the next generation, if not within 10 years.

I am not prepared to say what should be hoped for with the gas engine; but the indications at the moment would seem to be that, as we have a very much larger opportunity to reduce wastes that now characterize the gas engine than to extinguish those affecting the steam engine, more should be expected from the coming years with the former than with the latter. The gas engine has only now come to be a formidable rival of the steam engine and is gaining upon it rapidly. The deduction seems fair, therefore, that the next few years should see the gas engine so much improved as to permit it, for many places and purposes, to become a successful rival. In some directions, as at sea; in the locomotive, and perhaps in some other departments, it is possible that steam may continue to hold its place unchallenged, but this is by no means certain.

It is unquestionably the fact that to-day the gas engine is steadily overhauling the steam engine and as steadily displacing it in many directions. I think it extremely possible that it may ultimately displace it very largely, but I think that the steam engine is likely to hold a place among economically available prime movers for a long time to come, and no one can say what may be anticipated to follow its further improvement by effectively combining a maximum range of pressure and a maximum range of coincident temperature, the one giving maximum mechanical efficiency and the other maximum thermodynamic, the combination yielding what is the main object of selection in practically all cases—production of power with minimum costs on all accounts, production of power with least reduction of dividend-paying capacity.

A New District Messenger System.

Just what may be disclosed later as to telephone work grafted onto the district messenger system is not now clear, but it is interesting to note that the Postal District Messenger Company, with a capital of $10,000, has filed articles of incorporation in the office of the County Clerk of Hudson County, N. J. The articles provide that the business of the concern may be conducted in every State, Territory and colony of the United States. The company is incorporated to include the business of a common carrier and construct telegraph and telephone lines. The capital stock is fixed at $10,000, and the local agent of the company is Aaron C. Ackerman, of 99 Montgomery Street, Jersey City. The incorporators are W. H. Baker, Charles P. Bruch and John O. Stevens, all of the Postal Telegraph & Cable Company, and well-known telegraph men of long standing.

Mr. Baker is a vice-president and Mr. Stevens secretary of the Postal Telegraph & Cable Company. Mr. George G. Ward, vice-

president of the Postal, said that the organization of the new concern was simply a matter of legal expediency, and that it would be to the Postal what the American District Messenger Company is to the Western Union. The work it will do is not just the same as has been done hitherto by the telegraph company itself, and it will make no difference at all in the service.

Illumination at Washington During the Inauguration.

The electric lighting decorative displays at the National Capital for the second inauguration of President McKinley were remarkably fine. From the Peace Monument to the Treasury, and from there on to Seventeenth Street, incandescent lamps by thousands shed their glow over building fronts lining both sides of this historic thoroughfare. Other prominent streets and cross streets along the blocks entering Pennsylvania Avenue were also handsomely illuminated. The variety of the electrical decorations was striking. At one place one would see long streamers of white lights hanging from the top to the bottom of large buildings, at another every door and window was outlined by rows of lamps, and street awnings, with successive arches, studded with lamps strung across them. At other places the entire fronts of buildings were festooned with strings of lamps of various colors, with here and there large five-pointed electric stars, shields and flags. In several instances the current to the lamps in the flags was interrupted to give the effect of waving.

The use of electrically illuminated signs for advertising purposes has been steadily growing in Washington, but at this time new signs in great number seemed to spring up as if by magic, and the lamps in these signs were so numerous at many points that newspaper reading was of easy accomplishment in the centre of the street. Public buildings, office buildings and stores along the avenue operating isolated electric plants were all aglow. It was along this dazzling line of light the multitude slowly threaded its way to the Court of Honor, the name given that portion of the avenue from Fifteenth Street to Seventeenth Street, overlooked by the White House, the Treasury and the State, War and Navy Building.

There were four great white columns on each side of the court, surmounted by bronzed urns. Facing the White House were 14

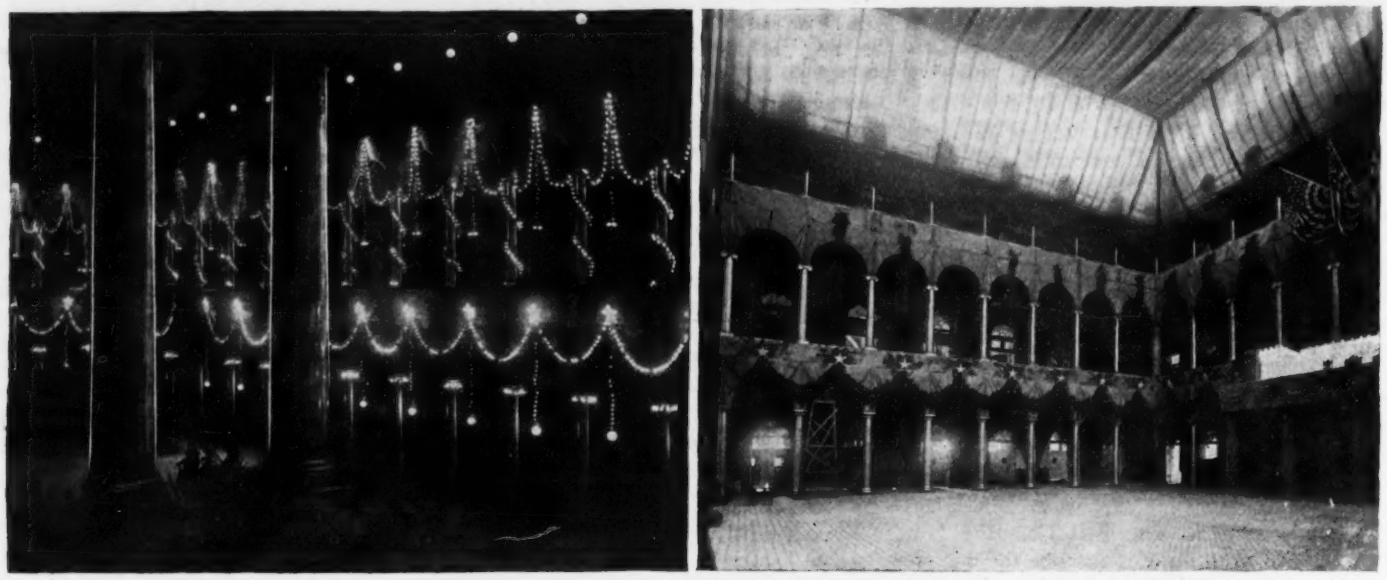


FIG. 1.—NIGHT AND DAY VIEWS, DECORATIONS, PENSION BUILDING.

round white columns, about 30 feet high, each topped by a globe studded with about 60 incandescent lamps, and the top of each column was encircled with lamps. Inside the White House grounds 18 similar columns were placed at equal intervals on each side along the carriage drive. At the ends of the Court of Honor were erected two ornamental roofed stands, finished in white. Under the eaves of these stands were rows of electric lamps. The night view of this court with the lamps aglow and the urns burning colored lights was one of great beauty.

After driving along the magnificent court and avenue, taking the

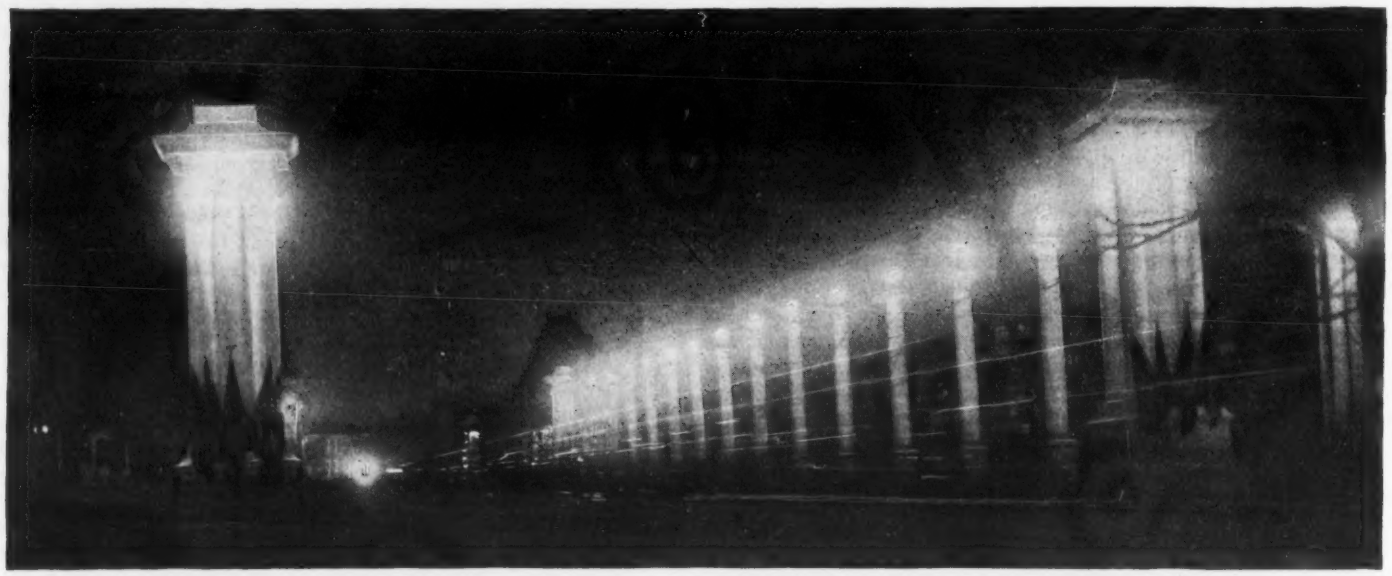


FIG. 2.—INCANDESCENT LIGHTING EFFECT, COURT OF HONOR, WASHINGTON.

oath of the highest office in the world, reviewing thousands of troops and veterans, the President returned to the White House to prepare for the inaugural ball at the United States Pension Building. This building, as is generally known, has been used on several occasions for inaugural balls. About a week before the date of the ball the clerks, with the exception of those in the mailing division,

were given official leave of absence, and the building was turned over to a small army of decorators and electricians.

Two No. 8 copper wires carried all the current used for light and power, prior to Feb. 27. Since then cables aggregating 1,500,000 cir. mil., with a capacity of 2500 amperes, were run into the building to a temporary switchboard, and the current distributed through the five main circuits to the lamps. The three-wire system was used, the wooden switchboard, covered with three layers of asbestos paper, had mounted on it a three-pole, single-throw feeder switch, capacity 2500 amperes, two 1500-ampere shunts to two Weston 1500-ampere shunt ammeters, one Weston 150-volt voltmeter, five current meters, four 500-ampere and one 300-ampere single-throw switches. From the switchboard the feeder mains are led to various parts of the building. Some idea of the amount of wiring done can be gathered from the fact that over 10 miles of wire were used.

A few words about the building and its decorations may not be out of place here. The inside dimensions of the ballroom are 316 ft. length by 116 width. Two balconies, supported by 76 gilded columns, overlook the ballroom. The ceiling was made of "old gold" colored bunting, supported on heavy wires, and draped on the sides and ends in graceful curves to hide the top balcony. The walls and balconies, with the exception of the columns, were completely covered with yellow cheesecloth. The short columns of the second balcony were decorated with needle pine, and on top of each was mounted a 32-cp incandescent lamp within a 12-inch ground glass globe. From a central point between these columns two strings of 20 electric lamps were hung and secured in graceful loops to the top of the columns of the balcony. From the same point there hung a string of 25 1-cp lamps, with 3 16-cp lamps in yellow flower-shaped paper shades at the lower end. Twined around each of the columns

FIG. 3.—A GLIMPSE OF PENNSYLVANIA AVENUE, INAUGURATION NIGHT.

of the first balcony was a string of 35 lamps. Over the center of each arch of the supporting columns of the first balcony was a silvered five-pointed star filled with 11 lamps. Festooned from star to star was a string of 28 16-cp lamps. Around the top of each column was a circle of 12 lamps. From the center of the lower arches hung a string of 25 1-cp lamps, ending with a 16-cp enclosed in a 12-inch ground glass globe. In the center of this immense hall there was a magnificent floral display arranged in and around the basin of a large fountain. The palms and other foliage plants were lighted by many hundreds of 1-cp lamps. The floral decorators followed the electrical wiremen and skillfully concealed every inch of the wiring with Southern smilax. Six hundred potted pink azaleas in groups of four were suspended above the capitals of the columns. The rooms of the President and the Vice-President were hung with many streamers of lamps, as was also the large banquet hall, built adjourning the Pension Building. The covered passages leading from the streets to the doors of the building were lighted by clusters of electric lamps. On March 3 the current was thrown on for the first time, in an instant transforming the Stygian darkness of the ballroom to the brilliancy of sunlight, flashing into view a scene of dazzling splendor, with "colors blending in one perfect harmony" under the glow of 16,000 lamps.

Without the aid of electricity the Court of Honor would have been cold and commonplace; the ballroom a vast gas-lit cavern. The tremendous task of installing the wiring and electric lights of the ballroom on time was entrusted to the Electric Motor & Equipment Company, of Newark, N. J. The work was done expeditiously by a large force of skilled men under the direct supervision of Mr. George E. Davis.

CURRENT NEWS AND NOTES.

STANDARDIZATION BUREAU.—The bill to establish a National Bureau of Standards passed both Houses of Congress at the last moment—the House on the afternoon of March 2 and the Senate the following evening. Several amendments were made to the original bill reducing items of appropriation, but none of these will materially affect the establishment or work of the bureau.

IOWA TELEPHONE ASSOCIATION.—The fifth annual meeting of the Iowa Telephone Association will be held at Des Moines, Iowa, on March 12 and 13. One of the questions to be discussed at the meeting is the matter of checking reports and making settlements between companies for their inter-line toll business. Another subject for discussion will be farmers' lines, their construction, equipment and rates of charge thereon.

PREPAYMENT WATT-HOUR METERS.—We have received from the Patent Office a belated budget of patents—11 in number—on prepayment electric meters, the date of issue being Jan. 29. All of the patents are assigned to the General Electric Company. Six were issued to Frank P. Cox, two to Eustace Oxley, two to Charles E. Holmes and one to Edmund Allo. The dates of application of the Cox patents are Sept. 13, 1897 (three), April 14, Oct. 8 and Oct. 12, 1898, the titles being prepayment electric meter (three), coin box for prepayment mechanisms (two), and prepayment mechanism. The applications for the Holmes patents were filed March 26, 1898, and Jan. 18, 1900, the titles being respectively, coin-controlled meter and coin-controlled mechanism. The applications for the Oxley patents were filed Oct. 28, 1899, and March 14, 1900, both titles being prepayment meters. The application for the Allo patent was filed April 20, 1898, the title being prepayment meter.

ELECTRIC RAILWAY CONTROLLER.—A patent was granted May 26 to Francis H. Shepard on a motor-grouping switch, and in the specific form of a series-multiple switch, which is operated through instrumentalities controlled by the current or counter e. m. f. conditions, or these combined, of the motors to be grouped. The illustrations accompanying the specifications show the invention applied to the controller of two motors by a master controller operating independent rheostatic and series-multiple switches through relays. With the exception of the series multiple arrangement the system is similar to that described in a patent granted to F. J. Sprague, dated Oct. 16, 1900. The claims are a combination in a system of control of a series-parallel switch, a rheostatic switch, a motor circuit, a governing circuit, means for operating the series-parallel switch controlled by the motor circuit and the governing circuit, means for locking the series-parallel switch controlled by the motor circuit, and means for unlocking the series-parallel switch controlled by the governing circuit. Another claim is the same as the above with "motor-grouping switch" substituted for "series-parallel switch."

THEATER DIMMERS.—Mr. Charles Wirt read a paper Feb. 25 before the Chicago Electrical Association on "Theater Dimmers," in which the subject was developed from its first beginnings in the earliest days of incandescent lighting. The paper states that Chicago is entitled to the credit of having had the first electrically lighted theater in the United States, and most probably in the world, the Halsted Street Academy of Music having been equipped electrically in 1882. The first form of fireproof rheostat was designed by Mr. John Van Vleck and Mr. Albert B. Herrick, and comprised a cast pipe frame, cast heads, porcelain insulators and galvanized steel wire coils connected to each other and to the copper division wires by brazing. In the earlier iron-clad rheostats plaster of paris was used as a filler, which later gave way to Portland cement. The latest and best practice for this form of rheostat is to use ground glass sand. The Auditorium Theater of Chicago has a total of 5000 lights; there are 50 32-cp lamps in the footlights and 6 ranges of border lights, numbering from 150 to 165 lights each, 32-cp lamps being used; there are 6 bunch lights and 18 strip lights, for which 32-cp lamps are also used. The footlights are provided in three colors. An efficient theater dimmer is made with 50 or 100 steps, according to size, and the cross-section of the conductor is graduated from the first step to the last in the ratio of 3 to 1. Even this large number of steps and the graduation of the conductor fails to give that smoothness of shading which is so much desired, making it necesary to decrease the resistance of the first steps more than the regular decreases caused by the taper of the conductor.

SPLIT-PHASE PATENT DECISIONS.—In the notices which appeared in recent issues of the decisions in the cases involving the Tesla split-phase patents, it should have been stated that the Westinghouse Electric & Manufacturing Company vs. the Dayton Fan & Motor Company were the parties to the suit.

DEVELOPMENT OF THE NERNST PRINCIPLE.—The article with this title, which appeared in our issue of Feb. 16, should have been accompanied by a foot-note (dropped out by the printer), stating that it was based on a thesis submitted by the author to the faculty of the Worcester Polytechnic Institute, Jan. 1, 1900.

BRITISH CABLE OPERATORS.—A cable dispatch from Halifax, N. S., says: "It is reported from the French island of Miquelon that the French administration has given the English cable operators, whom it has imported to operate the submarine lines ending at Miquelon, their choice of taking the oath of allegiance to France or resigning their jobs. Most of the men have done as was demanded rather than quit." "But their hearts are true to Poll."

LACHINE RAPIDS COMPANY.—The annual report of the Lachine Hydraulic & Land Company, of Montreal, shows a gross revenue for the past year of $269,401. The general operating expenses amounted to $79,607, and for betterment and repairs, $11,604, leaving a profit of $130,977 for the year. Two dividends, equal to 10 per cent for the year, were paid; $10,587 were added to the contingent account, and a balance of $4015 was carried forward to profit and loss. The company has been remarkably successful in the past, but it is likely to yield even better results in the future. It came out during the discussion on the annual report that the machinery now in use was working nearly up to its full load, and that the directors would shortly consider the advisability of installing the rest of the plant for which room had been provided in the power house. The plant now in use constitutes about two-thirds of the capacity of the power house.

THIRD-RAIL ELECTRIC RAILWAY.—Three patents were issued Feb. 26 to George H. Davis on details relating to the third-rail system of electric railway. The object of the patents is to provide an electric railway of the third-rail type possessing the advantage of other systems as far as concerns economy of construction, solidity and durability in operation, and ease of repair, while at the same time concealing the working conductor to practically the same extent as in those systems employing slotted contacts. Further objects are to provide an improved support for the current-collecting shoe which will permit the latter to co-operate with the working conductor with the greatest possible degree of efficiency; and to improve the construction and mounting of the working conductor. A series of brackets parallel to the third rail carries a continuous housing arranged so as to enclose the working conductor, there being an opening or slot in one side for the contact device. In one patent the rail is shown mounted in the usual way for contact on the upper face; in another patent the rail is mounted for side contact, and in the third patent is overhung and contact made with the lower face. The details of the mounting of the contact arm and of the contact shoe are covered by claims.

NEW YORK TO BOSTON.—A very intelligent correspondent writes to the New York *Sun* about the slow, bad train service from this city to Boston, and remarks very forcibly: "The New Haven road may some day find out that it has made a serious mistake in not cultivating the good will of its passengers by faster trains and more commodious equipment. There is every chance that the bill to make a high-speed electric railway between Liverpool and Manchester will be passed at the present session of the British Parliament. This is no mere promoter's scheme on paper, but a thoroughly well-designed plan for which the capital has been subscribed to run trains between Liverpool and Manchester, 35 miles in 20 minutes, or at the rate of 105 miles per hour. If the Liverpool and Manchester electric line proves a success from a financial point of view—its engineering difficulties are already considered solved by Sir William Preece and other eminent electricians—no two cities in this country would offer the same temptation for a similar line as New York and Boston. With a line 200 miles across country, five trains a day each way doing the journey in two hours, an average of 100 passengers to each train, and service 300 days a year, such a line might demand $10 for passage one way. This would give an annual revenue of $3,000,000. With operating expenses at 50 per cent of the gross receipts, there would remain $1,500,000 for interest and dividends, $1,000,000 of which would pay 4 per cent interest on $25,000,000 bonds, or enough to allow $125,000 a mile for construction and equipment. This is about the amount that the far dearer Liverpool and Manchester road is to cost. Before a serious proposition to build a road of this sort, the New Haven's opposition would be paralyzed. The lesson of which is that even a great railroad corporation with apparently all the avenues of transportation between two large cities in its grasp may repeat the saying attributed to the late W. H. Vanderbilt once too often."

STREET LIGHTING IN CITIES.—Mr. H. H. Humphrey, in a paper with this title read before the November meeting of the Engineers' Club of St. Louis, described the plant of the Imperial Electric Light, Heat & Power Company, which plant also furnished the subject of a paper read by Mr. George A. Damon in 1898 before the American Institute of Electrical Engineers. Several paragraphs of the paper give an account of trouble with the underground distribution from static discharges. It was believed that drawing both cables through a single iron duct leading to the base of the iron arc lamp poles used, would provide a sufficient connection between the two so that the lead sheaths would be practically connected together throughout the entire circuit. At the plant all of the six cables of the three circuits installed were also drawn into a single duct of the conduit with the same object in view. It was ascertained, however, soon after starting the plant, that these contacts were not sufficient. A static effect from the cables manifested itself in the short-circuiting of arc lamps through the insulation at the top of the enclosing globe where the full difference of the potential of the lamp is maintained. The lead sheaths of all the cables were then securely soldered together in the manholes where they enter the duct which goes to the lamp poles, and they are also connected together at the station just behind the switchboard. This, however, had little if any beneficial effect upon the portion of the circuit. A special static discharger was then installed, consisting of an ordinary Leyden jar condenser connected to the copper of each circuit at the rear of the station switchboard. Each condenser is provided with a revolving contact arm driven by a small motor, which alternately connects the condenser to positive wire, to ground, to negative wire and to ground, thus receiving a charge from the line and discharging it to ground about 30 times per minute. After this apparatus was installed the static effect of the cables was unappreciable in the operation of the plant. A test of the motor-driven arc-lighting units of the Imperial plant showed that the average efficiency of a unit was 80.5 per cent, reaching in one case as high as 82.5 per cent and another 82.4 per cent; the guaranteed efficiency was 78.25 per cent. At present the Imperial station has a maximum load of about 13,000 amperes, and an average load of 6345 amperes. During the past year the load factor of the plant has increased from 39.27 to 47.7 per cent. A switch is described whereby a number of incandescent street lighting circuits are switched in and out by means of current from the arc-lighting circuits. When the arc current is turned on it operates a solenoid which closes a switch controlling the incandescent street-lighting circuits. In the morning, when the arc circuit is shut down, the plunger of the solenoid is released, thereby opening a switch and cutting the incandescent lights out of circuit.

LETTER TO THE EDITORS.

Profitable Use of Inventors' Profits.

To the Editors of Electrical World and Engineer:

Sirs:—In the valuable issue of March 2, 1901, you quote from the *Iron Age* to the effect that pecuniary success would probably more often spoil than benefit an inventor. Some people will believe phrenological or clairvoyant statements of this kind, and therefore I would like to call to mind, by way of refutation, the well-known fact that as soon as an inventor profits financially, he uses his time and money for experimenting and making other inventions, or continues to be useful in some direction. The list of examples would take too much of your precious space. The Edison laboratory is a gigantic illustration. Permit me to start the names with the list of the 25 greatest scientists in your first issue of 1901. Practically all great scientists are discoverers and inventors. Were the following men spoiled by success? Edison, Bell, Westinghouse, Thomson, Brush, Sprague, Weston, Howe, Gatling, Mergenthaler—but the reader can go on with the list, as these are taken at random from memory, as a start.

Some ill-informed writers are continually harping upon the crank or unsuccessful inventor, but never before have I known of any one who considered it commendable that an inventor should remain as poor as he started. The would-be inventors, amateurs and cranks are not true inventors, and a person is not properly an inventor until his invention is in public use. Then the more money he makes the more inventions he will make, or try to make, and, therefore, the more will the public be benefited. The amateur should be encouraged, for he is an embryo of a famous and wealthy man. In addition to the long array of inventors of world-wide reputation, there are hosts of minor lights in all the factories in the world—not, perhaps, wealthy—but receiving handsome royalties, dividends from stock or salaries.

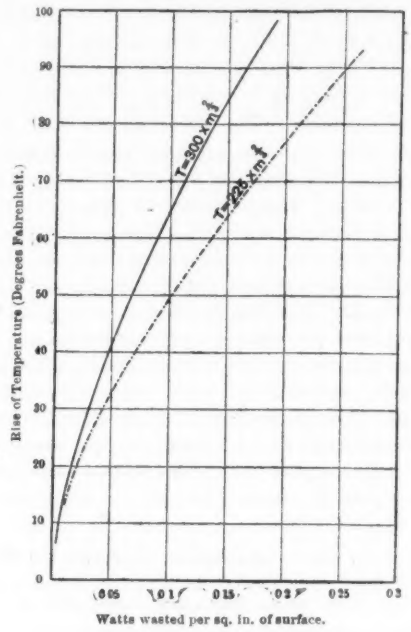
EDWARD P. THOMPSON.

NEW YORK CITY.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Transformers.—WOODHOUSE.—The first part of a paper on "The design of transformers." After some general remarks on transformer design and a brief summary of the relative advantages of core transformers and shell transformers, he gives examples of suitable dimensions for both types. With the aid of diagrams he explains the terms no-load current, magnetizing current and hysteresis current, and shows how to calculate the same, and also the efficiency. He then discusses the temperature rise of a transformer. Heating depends upon the watts wasted per square inch of radiating surface, and upon the conditions of cooling, whether the transformer is cored or not, whether oil or air cooling is used, etc. If two similar transformers are considered in which the linear dimensions of the one are n times that of the other, then if the value of the maximum flux density in lines per square inch be kept the same and the same proportion of space be occupied by the winding, in each case, the cool ing surface will only increase as $n^2 : 1$, while the output increases as $n^4 : 1$; great care must therefore be taken in large transformers to keep the temperature rise small. Oil cooling is much to be recommended as it tends to equalize the temperature of the whole transformer. The following rules are said to hold good where the value m of the total watts wasted in a transformer per square inch of cooling surface is not greater than 0.4: for an air-cooled transformer with

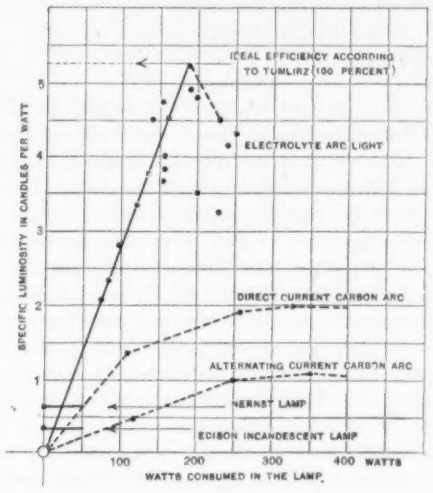


TRANSFORMER CURVES.

natural draft the final rise of temperature in degrees Fahrenheit is $300 \times m^{2/3}$, while for an oil-cooled transformer the same rise is $225 \times m^{2/3}$. Curves corresponding to these rules are given in the adjoining diagram.—Lond. *Elec.*, Feb. 15.

LIGHTS AND LIGHTING.

New Electric Arc Light.—RASCH.—An illustrated article in which he gives the principles of a new electric arc light, which, in its production and action, is somewhat similar to the Nernst light, as the electrodes of the arc are made of very refractory solid electrolytes, as magnesia, oxide of thorium, oxide of zirconium, oxide of calcium, etc. In order to obtain an arc between such electrodes, the same must be heated before, just like the incandescent rod of the Nernst lamp. He claims that the technical difficulties are here much smaller than in the Nernst lamp. The energy density at the ends of the elec-


IDEAL EFFICIENCY ACCORDING TO TUMLIRZ (100 PERCENT.)
ELECTROLYTE ARC LIGHT
DIRECT CURRENT CARBON ARC
ALTERNATING CURRENT CARBON ARC
NERNST LAMP
EDISON INCANDESCENT LAMP
SPECIFIC LUMINOSITY IN CANDLES PER WATT
WATTS CONSUMED IN THE LAMP.

NEW ARC LIGHT.

trodes is very great, 30 to 40 watts per square millimeter or more; the temperature is therefore also very high. The arc between magnesia electrodes or between electrodes of oxide of zirconium is white like sunlight. The light is produced not only at the ends of the electrodes, but the gases also participate in the light production. By a special choice of suitable material for electrodes a light may be produced, the color of which suits special purposes; for instance, electrodes made of magnesia, calcium fluoride, oxide of chromium, and oxide of nickel, give a yellow light. Electrodes of 0.1 or of 0.2-inch diameter yielding 600 to 1000 candles, give 3 to 4 candles per watt; or consume only 0.25 to 0.3 watt per candle. When the length of the arc is kept constant, the ratio giving candles per watt increases with increasing watts. In his experiments the candles were found to be proportional to the square of the watts to a certain extent. He calls attention to the fact that the specific luminosity in candles per watt, with constant arc length, increases up to 5.21 candles per watt, and then decreases. This maximum was obtained in his experiments at 200 volts. The electrodes then became liquid. This is of theoretical interest because Tumlitz in his investigation of the mechanical equivalent of light has shown that an ideal efficiency of 100 per cent corresponds to 0.192-watt per candle, or 5.21 candles per watt. For practical purposes he recommends burning the arc with 3 to 4 candles per watt. He claims that this new arc light is considerably cheaper than the Welsbach incandescent gas light. In the adjoining diagram a comparison of the specific luminosity in candles per watt is given for different electric lamps. The ordinates give the watts consumed in the lamp. It is evident that the electrolyte arc light is by far the most economical—*Elek. Zeit.*, Feb. 4.

Arc Lighting from Constant-Pressure Mains.—ADAMS.—An article on "The economic radius of arc-lamp service from constant-pressure dynamos." He remarks that great extensions in the service of arc lamps directly from constant pressure supply mains is constantly going on under two distinct conditions: First, the supply of arc lamps in multiple from the same mains that deliver energy to incandescent lamps; second, the case in which series of two or more arcs are

operated at constant pressure, because all of the lamps in each series are wanted when any are necessary, as in some large buildings and in street lighting. The greatest impediment to this development is the cost of copper of the line. As incandescent lamps are operated at 110 or 220 volts, series arc lines at 2000 to 3000 volts, it is obvious that the economic radius of distribution for arc lamps at those low voltages must be much less than that with ordinary arc dynamos. He gives several numerical examples and finds that more than one or two arc lamps may often be supplied by an extension of a constant-current circuit to distances of one-half mile or one mile from given points on it. Unless more than 8 arcs can be connected over the distance of one mile, or more than 4 arcs cover the distance of one-half mile, from any point, where constant current and constant pressure circuits coincide, the constant-current circuit offers no saving of copper for the line efficiency. Where the mains and feeders of three-wire systems at 220 to 250 volts are extended to distances of as much as one mile from the central station, branches for those three-wire mains may be economically extended in any direction to a distance of one mile for arc lamps, so that if the station is in the center of the district served, arc lamps may be supplied over an area four miles square where 220 or 250-volt incandescent lamps are distributed on the two wire-system, the advantages for arc-lamp distribution remain the same as for the three-wire system using 110-volt lamps.—*Elec. Rev.*, Feb. 23.

POWER.

Cost of Power.—Brown.—A paper read before the Eng'ing Ass'n of the South at Nashville, Tenn. From reports of a number of large power stations, between 4000 and 600-hp capacity, he gives the cost of one indicated horse-power per year as follows: On the average, it is $41.21, while in the most expensive and in the most economical plant, it is $71.10 and $30.96, respectively. For a small plant of, say, 10-hp capacity, he gives the total cost of one indicated horse-power per year at $54.48 for good practice, $68.94 for average practice, and $84.15 for poor practice; also the cost of one effective horse-power year in these three cases at $72.64, $106.06 and $210.40, respectively, under the assumption of 75, 69 and 40 per cent mechanical efficiency, respectively. Data are also given on the working of locomotives and of gas engines.—*West. Elec.*, Feb. 23.

Gas Power for Central Stations.—A communication, by Humphrey, in which he says that while the cost of generation and transmission must be considered together, there is no apparent and obvious reason why a cheap gas, like the Mond gas, with the more expensive transmission should not be much better in the end than more expensive rich gas. On the other hand, the editors express in a note, the opinion, that a richer gas, even though costing more to manufacture, is better for long-distance transmission. Producer gas consists largely of nitrogen, and, to some extent, of other inert gases, and although it can be produced very cheaply, yet it does not pay to pipe-line it over long distances, because of the much greater capital outlay on larger pipes and gas holders, and because of the extra cost of forcing large volumes of useless gas through the mains. —Lond. *Elec.*, Feb. 15.

Electric-Driving of Hoists.—An anonymous article giving some practical notes on the driving of hoists by electric motors. He has made experiments with direct-coupled electric hoists with the motor coupled onto a worm shaft, and arranged to rotate in either direction, controlled by means of a resistance and reversing switch. With this type of hoist driving, he found the greatest trouble when the hoist was traveling repeatedly from one floor to the next only, the motor requiring much more attention and the starting switch constant renewal of contacts, thus the labor item became prohibitive. He recommends working an ordinary type of mechanically-driven hoist, suitably loaded, by means of an electric motor. Such a hoist, which has given great satisfaction, is illustrated. There are precautionary measures for the prevention of accidents. The reversal of the hoist by the counterweight is prevented by the use of a finely pitched worm and worm wheel, thus ensuring safety in case of failure of the belts. Automatic stopping and lock motion for each floor; self-opening and closing doors. In a table he gives the power absorbed in driving motor and working hoist with different loads.—Lond. *Elec. Rev.*, Feb. 15.

TRACTION.

Electric Tramway Statistics of Germany.—The very full annual statistical tables, filling 16 full pages, and giving a large amount of information on the electric tramways and railways in Germany on Sept. 1, 1900. As a special accomplishment of the last year, the introduction of electric traction on the Wannsee R'y between Berlin and Fehlendorf is mentioned. Although this is only a small trial on a main line of 7 miles, the success of this experiment is said to have been so great that electric traction will come into more extended use in the near future on short sections of main lines with a great passenger traffic. The Berlin-Fossen Railway, which has a length of 18 miles and probably will be opened this summer, will also be used for important experiments with electric high-speed service on main lines. The number of centers of electric tramway systems was 42 in 1896, 68 in 1898, 99 in 1900. The length of lines 350, 858, 1731 miles, respectively. The length of track 512, 1163, 2553 miles. The number of motor cars 1571, 3190, 5991. The number of trailers 989, 2128, 3962. The capacity of the electric machinery 18,560, 33,333, 75,608 kw. The capacity of storage batteries in tramway stations 0, 5,118, 16,890 kw. The trolley system is used almost entirely. Besides this, in some cities a mixed trolley and accumulator system is used, the accumulators on the cars being charged on those parts of the roads where the trolley is used. This system has not been successful in Berlin, and will be replaced by the trolley system, with the exception of some brief sections where a conduit system will be used. The conduit system is in use at present only on three short roads in Berlin, Dresden and Dusseldorf, of together two miles in length. The pure accumulator system is also used only in three cases. This system is, however, in use on two lines of 30 and 36 miles length of main railways in Bavaria for special trains. A new system in Germany is the third rail, used on the Wannsee R'y.—*Elek. Zeit.*, Feb. 7.

Conduit System in London.—An article giving some information on the conduit system it is proposed for use on three routes of the London County Council tramways. An illustration gives a general view of the conduit. The slot rails are of steel, the slot being ¼-inch wide. The conductors carrying the electric current will be soft-steels tees, carried within a concrete conduit. Some particulars are given concerning the mechanical construction of the conduit. The conductor tees will be divided by section insulators into sections not exceeding half a mile in length. Each section of the conductor tees will consist of a positive and negative length in each conduit. Normally, each of the two conduits will be electrically separate from the other, and will be supplied from feeders having a branch for each section. Automatic cutouts and cross-over switches will be provided for each section, and are so arranged that in the event of a fault occurring and persisting on the positive of any section the polarity of the two conductors in that section can be reversed, so as to throw the fault on the negative where it can remain until the stoppage of traffic at night allows it to be located and rectified. The voltage will be 500.—Lond. *Elec. Eng.*, Feb. 15.

Central London Railway.—An editorial in which the accounts for the first five months of working of the "Two-penny Tube" (underground electric railway), are analyzed. There is a uniform charge of 4 cents for any distance traveled. The total capital created includes $14,250,000 in shares and $4,380,000 loan, or a total of $18,630,000. Of this, $17,560,060 have been expended on works and rolling stock. During the first five months 14,916,932 passengers were carried, about 3,000,000 per month. The actual service train-mileage was 486,004. The revenue derived was nearly $600,000, and the working expenses $352,000, so that the ratio of expenditure to revenue was nearly 59 per cent. A considerable reduction of this ratio is expected in future. A dividend is recommended on the share capital at the rate of 2½ per cent per year. This financial result is regarded as a satisfactory one, but far better results are expected in the near future.—Lond. *Elec.*, Feb. 15.

Guard Wires.—An illustrated article referring to the serious accident which recently occurred in Liverpool, when telephone wires came into contact with the trolley wire. Guard wires are not used at Liverpool, the guard in use being what is known as the wooden strip guard. This is illustrated. It is pointed out that the use of the wooden strip must be discontinued in favor of guard wires. A good system of guard wires is described and illustrated. There is also required a device for arresting the passage of any high-voltage current that may enter a telegraph wire. This is accomplished by a fine platinum fuse, fixed generally on each side of the point at which the telegraph and trolley lines cross each other.—Lond. *Elec. Rev.*, Feb. 15.

High-Speed Electric Railway.—A note on plans of the German company which has been formed for the purpose of studying the problem of high-speed electric railways, the leading electrical firms and industrial banks of Germany participating in this investigation,

as noticed before in the Digest. No actual experimental line has yet been constructed, but it is proposed to build, as a trial, a military line intended for a speed of from 125 miles to 150 miles per hour from Berlin to Fossen.—Lond. *Elec.*, Feb. 15.

Electric Traction on Main Lines.—WIECHEL.—An article referring to a remark in the recent paper of Langdon. He shows that it is of commercial value also for merchandise traffic to let shorter trains be runs at more frequent intervals.—*Elek. Zeit.*, Jan. 31.

Automobile.—An illustrated description of the Holson automobile, which consists of a seat and carriage frame suspended between two very large wheels, each containing a motor in its hub. The motor is placed cross-wise of the axle, with a pinion on each end of the motor shaft. The pinions operate on oposite sides of a two-faced bevel annular gear. The motor is entirely encased. The motors are multipolar and series wound, each giving 1 hp. He claims a large advantage of having two 1-inch pinions on the same shaft. gearing into a 12-inch gear wheel. With a 1-hp motor each pinion will deliver ½ hp to the wheel. With each revolution of the wheel each pinion will revolve 12 times on its own axis, while a single 2-inch pinion that would be necessary with a 1-hp motor and a third gear to give the same power would only revolve 6 times on its axis. The diameter of the entire hub casing is 13 inches, while that of the wheels is 6 ft. 3 in. The storage battery weighs 1200 lbs., and being suspended below the axle and at the lowest part of the frame, serves to keep the seat right side up. It consists of 40 cells and has a capacity of 30 amperes at a three-hour discharge rate.—*West. Elec.*, Feb. 23.

REFERENCES.

Polyphase Railways.—PERKINS.—The first article of an illustrated serial on polyphase electric railways in Europe. He deals with the road from Zermatt up to the Gornergrat.—*El'ty*, Feb. 20.

Electric Locomotives.—An illustrated description of modern electric locomotives of foreign and American make.—*Elec. Rev.*, Feb. 23.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Fulham.—A long, well illustrated description of this new British municipal lighting plant in combination with a refuse destructor. The destructor house contains 12 destructor cells, capable of destroying efficiently 120 tons of refuse in 24 hours. The destructor gases alone will be able to furnish sufficient steam to maintain the boiler pressure at 100 lbs. per square inch up to a certain load, but it is not anticipated that they will suffice at large loads. There will be considerable consumption of coal in the boiler furnaces, and a coal-handling plant is being put down. It is estimated that the amount of refuse passed through the destructor per year will be approximately 40,000 tons, and its calorific value is placed at one-twentieth that of good steam coal. It is, therefore, expected to save the cost of 2000 tons of coal per year. There are three steam-driven two-phase alternators of the flywheel type, each giving a normal output of 300 kw, each of the two sets of coils being capable of giving 150 kw at all e. m. f.'s from 2800 to 3000 volts at the terminals of the machines. There are also three 60-kw direct-current dynamos for exciting and light and power supply in and about the works. Three Ferranti rectifiers are used for supplying the public lighting circuits. The two-phase 3000-volt current is led by means of pairs of concentric lead-covered cables to five sub-stations, each containing two 50-kw transformers, one for each phase, for transforming each phase down to 200 volts and distributing at that pressure to the consumers. In the low-pressure cables the phases are also kept apart, and one is used on each side of the street. If a motor is required, a service line is run across the street and both phases are brought in. The charge for lighting is 10 cents per unit, and for motive power 5 cents during the hours of daylight.—Lond. *Elec. Elec. Rev.*, Feb. 15.

REFERENCES.

Austria.—PERKINS.—An illustrated article on alternating-current development in Austria. Some information is given on the single-phase and two-phase systems of Vienna, the three-phase system of Trieste, and the Bozen-Meran high-tension, polyphase power transmission.—*West. Elec.*, Feb. 23.

Charging for Energy.—WILKENS.—An article illustrated by diagrams, in which he develops the principles of the maximum demand system of charging, and gives some numerical examples from German practice.—*Elek. Zeit.*, Feb. 7.

WIRES, WIRING AND CONDUITS.

Fire Due to Short Circuits.—SCHINKE.—A communication on experiments made during several years on a tramway line with insufficient rolling stock, where there were often accidents. He claims that scarcely a fire was due to a short circuit. Fires which occurred could be proven to be due to other causes. A continuous passage of a small current is more dangerous than a sudden direct short circuit. —*Elek. Zeit.*, Feb. 7.

ELECTRO-PHYSICS AND MAGNETISM.

Anti-Coherers.—MARX.—An illustrated account of an investigation of the action of Schaefer's "anti-coherer," which consists in dry slits scratched in a silver film deposited on glass and covered by a thin layer of celluloid. When electric waves fall upon such a device the resistance falls at once, while in Branly's coherer the resistance increases. For this reason Schaefer's plate is called an anti-coherer. When the electric waves stop the anti-coherer at once assumes the original resistance again. He has examined the conditions which govern the sensitiveness of Schaefer's plate. He finds that the celluloid film does not penetrate into the interior of the gap, being unable to overcome the capillary repulsion. The chief effect of the celluloid is to prevent the dissipation of the minute particles of silver which partly fill up the gap, and whose motion under the influence of electric waves is probably one of the causes of the temporary increase of resistance, although it does not fully account for it. These anti-coherers are just as sensitive as Branly's coherers, but require no tapping, and are much freer from accidental disturbances.—*Phys. Zeit.*, Jan. 26; abstracted in Lond. *Elec.*, Feb. 15.

The Electric Analogue to the Zeeman Effect.—VOIGT.—A theoretical investigation of the electric analogue to the inverse Zeeman effect. The effect to be expected would be the following: "A body with fine and sufficiently separated absorption lines, shows for ordinary light traversing it parallel to the electric lines of force (without double refraction), a displacement of these lines without separation, while for light traversing it normally to the lines of force (with double refraction), it shows a displacement with accompanying separation." He arrived at an estimate of the magnitude of the phenomenon looked for. The effect would be very minute, as even in the case of the greatest known electric double refraction, with a potential gradient of 300 volts per centimeter, which is not easy to produce in a vapor, the effect to be observed would not exceed the 20,000th part of the distance between the two *D* lines.—*Ann. der Physik.*, No. 1; abstracted in Lond. *Elec.*, Feb. 15.

Velocity of Ions Drawn from a Flame.—CHILD.—An account of an experimental investigation, with a method for determining the velocity of ions in a gas, suggested by J. J. Thomson. He found that the velocity of the positive ions drawn from a Bunsen burner is approximately 2.2 cm per second for a potential gradient of one volt per cm., and that for negative ions 2.6 cm. In the case of an unlimited supply of ions, if the discharge takes place between two regular surfaces, the velocity may be determined by simply measuring the current per unit area and the difference of potential between these surfaces, and if the surfaces are not at all regular the relative velocities of the positive and negative ions may be determined by comparing the positive and negative currents. He promises an account of an application of this method to the comparison of the velocities of the positive and negative ions drawn out from an electric arc.—*Phys. Rev.*, Feb.

Conductivity of Positive Light.—STARK.—An account of measurements of the conductivity of unstratified positive light columns of considerable length. As in that portion of the discharge the transverse conductivity and the gradient are constant for relatively large distances, the gas can be assumed to be there in a uniform condition and to possess no internal e. m. f.'s. The conductivity depends upon the current density. For great densities the conductivity increases more rapidly than the current density.—*Ann. der Physik.*, No. 1; abstracted in Lond. *Elec.*, Feb. 15.

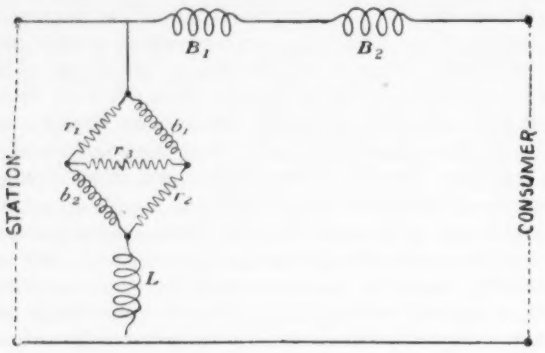
Induction-Coil Phenomenon.—JOHNSON.—An account of an investigation of the phenomenon that when a voltmeter is inserted in the secondary circuit of an induction coil, hydrogen and oxygen gases are developed at both electrodes. He found that the electrolytic decomposition of the water is due only to the oscillations of the opening current, and that no visible electrolysis is produced by the closing current.—*Ann. der Physik*, 1900, v. 3, p. 744; abstracted in *Elek. Zeit.*, Jan. 31.

Remanent Magnetism.—HOLITSCHER.—An abstract of a paper giving an account of an experimental investigation of the remanent mag-

netism of iron. Among other things he studied the influence of the duration of magnetization upon the remanent magnetic momentum. With increasing duration of magnetization the remanent momentum increases first, but after a certain value, "the duration of saturation," the momentum remains constant. This duration of saturation increases with the magnetizing force. Remanent magnetism is found also with exceedingly small magnetization.—*Elek. Zeit.*, Jan. 31.

UNITS. MEASUREMENTS AND INSTRUMENTS.

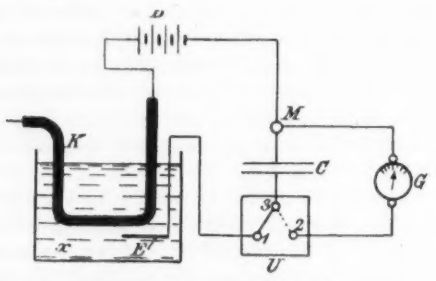
Adjustment of Induction Meters.—A short illustrated note showing the method used by Siemens & Halske to overcome a certain difficulty in the adjustment of alternating-current induction meters. Such meters, in which a revolving field is produced, are subject to two adjustments. The first, that of the shunt winding, is for producing a field which is exactly in quadrature with the difference of potential; the second adjustment modifies the intensity of the field so as to enable the reading to be made directly, thus avoiding the use of a coefficient. Each one of these adjustments generally affects the other, so that the ultimate results often require numerous trials before both are correct. To avoid this, the apparatus is connected, as



ADJUSTMENT OF INDUCTION METERS.

shown in the adjoining figure, in which B_1 and B_2 represent the chief coils, b_1 and b_2 the shunt coils, which produce the field in quadrature. The adjustment of the phase shifting is effected by varying the known inductive resistance, r_2, and the adjustment of the intensity of the field is effected by simultaneously varying the two resistances, r_1 and r_3. Those five resistances thus form a Wheatstone bridge connected in shunt with the lamps, and in series with a high self-induction coil, *L.*—*L'Ind. Elec.*, Jan. 25.

Measuring Insulation Resistance.—RABINOWICZ.—An illustrated description of a simple method of testing the insulation resistance of conductors. It is illustrated in the adjoining figure where *G* is a galvanometer, *U* a switch for connecting 3 either with 1 or 2, *x* an insulated basin of water, *K* the cable to be tested, *E* a copper plate placed in the water, *B* a battery of 20 volts, *C* a condenser of about



MEASURING INSULATION RESISTANCE.

1 microfarad. The electricity passing through the insulation of the cable is used to charge the condenser, *C*, while 3 is connected with 1 in the switch, *U;* after a certain time this connection is broken and 3 is connected with 2, so that the condenser is discharged through the galvanometer. To compare the insulation resistance of different cables, the condenser is charged for the same time and the deviations of the galvanometer in the different cases are compared. That cable for which, with equal time of charging the deviation of the galvanometer is the smallest, is the best. He has found that in general impregnated paper insulation is to be preferred to insulation with impregnated cotton.—*Elek. Zeit*, Jan. 31.

Mixed Currents.—An anonymous article on the "Sifting of mixed currents," i. e., currents obtained by the superposition of an alternating current upon a direct current in the same conductor. An instrument for direct current only, such as a galvanometer of the coil and magnet type, of which either the coil or the magnet is movable, measures the direct current only; for measuring the alternating part, a dynamometer is required. He gives the formulas, relating to such measurements. A very convenient form of voltmeter applicable in cases of mixed currents, consists of a galvanometer of coil and magnet type, and a hot-wire instrument connected in series. The hot-wire instrument gives the square of the direct-current voltage plus half the square of the alternating-current voltage. The galvanometer gives the direct-current voltage alone. He makes an application to an experiment of Duddell, in which an oscillation is produced in an otherwise direct current by means of a condenser and an arc light.—Lond. *Elec.*, Feb. 15.

Bolometer.—KURLBAUM.—A description of a remarkable improvement of the sensitiveness of the bolometer. This is accomplished by placing it in a vacuum. In this way the rise of temperature due to absorption of heat, and hence also the efficiency is considerably increased. Moreover, the air currents produced by the heated bolometer, which produce the well-known disturbances of the galvanometer needle, are also done away with. The vacuum bolometer is peculiarly fitted for the measurement of Röntgen ray intensities, since polished platinum is used for that purpose and the loss by radiation is then very small. The sensitiveness of the bolometer can be thus increased 40 or 50 times.—*Phys. Zeit.*, Jan. 26; abstracted in Lond. *Elec.*, Feb. 15.

REFERENCES.

Measurements in Alternating-Current Circuits.—A communication by Sumpner pointing out some inherent sources of error in Campbell's "Phase-turning device," which was mentioned before in the Digest. Also a reply by Campbell to Duddell's criticisms. He also describes a modification of the three-voltmeter method which might be used with advantage when the power factor is low.—Lond. *Elec.*, Feb. 15.

Recording Alternating-Current Waves.—LAWS.—An illustrated description of an apparatus for recording alternating-current waves. It is a modification of the "Contact method," by which the record is rendered continuous and traced photographically.—*West. Elec.*, Feb. 23.

Testing Alternating-Current Meters.—ORLICH.—An illustrated article on the methods and apparatus used in the German Reichsanstalt for testing alternating-current meters. The tests of motor meters, pendulum meters and three-phase meters are separately discussed.—*Elek. Zeit.*, Jan. 31.

Magnetic Tests of Iron.—CAPITO.—A communication criticizing a special point in Kamp's article on the errors in magnetic measurements, due to the surface film of iron sheets. (Digest, March 2.)—*Elek. Zeit.*, Feb. 7; also a brief communication by Roehr on the same subject.—*Elek. Zeit.*, Feb. 14.

Testing Cells.—An illustrated description of the cells and batteries used in the British Navy for testing purposes or for performing some kind of work. The methods of testing are also described.—Lond. *Elec. Rev.*, Feb. 15.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Arc Telephony.—SIMON.—Independently of Duddell's recent improvements in the "speaking arc," he has made a number of advances in the construction of his arc "radiophone," which promises to place wireless telephony with the aid of light upon a basis of practical success. He has confirmed the supposition, advanced by Brown, that the intensity of sound is in direct proportion to the intensity of the current upon which the microphone currents are superimposed. This is no doubt due to the fact that the Joulean heat is directly proportional to the square of the current, and that the sounds emanating from the flame are produced by variations of its temperature. He uses a projection-arc lamp with differential gear, and a current of 16 to 20 amperes. To increase the distinctness of transfer, the change of resistance of the microphone must be small. As a receiver he uses by preference a selenium cell, placed in the focus of a searchlight mirror. Experiments were successful with distances of 65 ft., but the author expects that Bell's radiophone limit of 800 ft. will soon be very considerably exceeded.—*Phys. Zeit.*, Jan. 26; abstracted in Lond. *Elec.*, Feb. 15.

Wireless Telegraphy.—GUARINI.—A communication referring to some experiments which he has made between Malines and Brussels.

He found that a large receiving surface is advantageous for the receiving air wire. He tries a theoretical explanation of the advantage of using one wire or cylindrical wires for the transmitting air wire, instead of a stranded or even lightly twisted cable. He concludes that "the maximum action between a transmitting and receiving air wire is obtained by using as air wire two metallic right cylinders of a certain height (length), and a certain diameter, disposed parallel to one another in the two stations, and of such a height that they are in sight of one another. Assuming that the two cylinders are of equal length, each must be included entirely between the two planes passing through the base of the other."—Lond. *Elec.*, Feb. 15.

Multiplex Telegraphy.—GILTAY.—An article, illustrated by diagrams, in which he suggests a system of multiplex telegraphy, Morse signals being transmitted by alternating currents of different periods. Each station gives an alternating current of an exactly fixed period, each other station one of another period. When the line is used at the same time for different telegrams, the waves of different periods must be separated at the receiving stations. This is done with the aid of tuned organ pipes and resonators.—*Elek. Zeit.*, Jan. 31.

MISCELLANEOUS.

REFERENCES.

Lightning Rods.—FINDEISEN.—A long reply to some criticisms of his views on the best construction of lightning rods, which had been expressed in a discussion of the subject in the Electrotechnical Society of Berlin.—*Elek. Zeit.*, Feb. 7.

Obituary.—A long account, by Fontaine, of the life and work of Zenobe Gramme, with his picture.—*L'Ind. Elec.*, Feb. 10.

Paris Exposition.—GIRAULT.—The conclusion of his well illustrated article on alternating-current machinery exhibited by Schneider & Co. This part deals with three-phase and single-phase transformers.—*L'Ind. Elec.*, Jan. 25.

HAUSSEGGER.—The first part of a well illustrated article on alternating-current dynamos and transformers exhibited by Ganz & Co.—*L'Ind. Elec.*, Feb. 10.

KORDU.—An illustrated description of a 1600-hp Farcot two-phase alternator, with Leblanc's "amortisseurs."—*Elek. Zeit.*, Feb. 7.

New Book.

THEORY AND CALCULATION OF ALTERNATING CURRENT PHENOMENA. By Charles Proteus Steinmetz, with the assistance of Ernst J. Berg. Third edition, revised and enlarged. New York: Electrical World and Engineer. 525 pages, 210 illustrations. Price, $4.00.

The third edition of the work before us contains such a wealth of information that the reviewer is embarrassed in making a choice of parts for particular comment. A work of Mr. Steinmetz requires no praise, for what but meritorious could come from so gifted and talented a man?

It need hardly be said that the book is not for the tyro who intends to tackle alternating currents and learn all about them in the span of a few weeks or months. The book itself is a good illustration of the largeness of the realm of alternating currents. It is no introduction to alternating currents, but it is a wonderful book for the profound and earnest student, taxing his mathematical and reasoning powers to the utmost, and, in general, rewarding him for his pains.

There is, right at the outset, a chapter perhaps the most charming and original of the whole work. We allude to the sixth chapter, entitled "Topographic Method." The diagrams for a transmission line with distributed capacity, inductance, resistance and leakage are conspicuous by solving with the greatest ease in the most elegant manner a problem at first sight appearing most abstruse and complex. These diagrams go to show that their author is as familiar with graphic methods as he is with the algebra of complex imaginary numbers.

Another most admirable chapter is the eleventh, on "Foucault or Eddy Currents." Clear, simple and concise, it is a perfect example of how mathematics should be applied to the solution of physical or engineering problems. No waste of thought occurs in this chapter—the results are reached by the shorter road. A paragraph is devoted to the unequal current distribution in conductors through eddy currents, or the phenomena usually termed "skin-effect."

Chapter XIII deals from the mathematical point of view with the problem of distributed capacity already treated in the sixth chapter by the topographic method, as throughout the volume, the authors treat and solve this problem with the help of complex imaginary numbers.

Chapters XIV, XV and XVI treat of the theory of the alternating current transformer and of the induction motor, with an elaborate and most instructive theory of the concatenation of these motors. The authors start by developing the vector-diagram of the transformer and then go on to express all quantities in the symbolic method, a procedure highly to be recommended.

The name "frequency converter" is made use of for the general alternating current transformer with revolving secondary or primary, as illustrated by the induction motor. Though the treatment is almost everywhere clear and comprehensible, and though diagrammatic representation is often made use of for elucidation, yet it cannot be denied that the formulas are rather appalling, though this is more in seeming than in reality. Might not a graphic treatment of the involved phenomena in transformers and motors after all prove more perspicuous and lucid? It would hardly be considered justifiable, as it was once done, to express the motion of a slide-valve in mathematical raiment, owing to the fact that the slide-valve diagram is simpler and fully answers the purpose. It is not the complexity of the solution, it is the fact that there is a simpler solution possible, that makes us, to say the least, regret the absence of a detailed graphic treatment of the questions involved.

Steinmetz's great work suggests another important question, viz., whether we are justified in giving in a book, written obviously for engineers and not for mathematicians, purely theoretical and mathematical deductions without giving experimental illustrations, as long as there are methods available which, without abating an iota of accuracy, would lay the results before the student in a more tangible and palpable form?

Most interesting and suggestive is also the chapter on the synchronous motor. Graphic methods are constantly made use of in this chapter, but we must own that Prof. Blondel's development of the V-curves represented in Figs. 154 and 155 is briefer and more elegant. In this place we cannot forbear from remarking that it is surprising that in a scientific work of this kind no references are made to the works of other workers in the same field. There is hardly a problem in the wide field of alternating currents on which the best theorists have not tried their strength. Far from disputing the originality of the work of a man of such natural mathematical genius as Steinmetz, it has to be borne in mind that most of the problems in alternating currents with which this book deals were not first solved by the author, though the author is doubtless in America the foremost representative of the laborers in alternating current theory.

The most prominent features of the book are so well known as to require little comment. A new, but rather brief, chapter on the transformation of polyphase systems has been added and the two appendices on the "Algebra of Complex Imaginary Quantities" and on "Oscillating Currents" conclude the book, as in the first and second editions.

The use of complex imaginary quantities cannot highly enough be recommended. The student of mathematical physics knows that since the time of Sir William Rowan Hamilton's great work on quaternions, vector-algebra has developed into a most powerful calculus. All men of great mathematical genius seem to have recognized the power of the symbolic method. What admirable use was made of this method, students may see from the works of that most powerful mathematician, William Kingdon Clifford, whose name we may not write without the expression of deepest regret that such a noble mind was lost to the world in the early prime of its powers without being able to finish a great work. We cannot think of a more useful introduction to Steinmetz's book than Clifford's "Common Sense in the Exact Sciences," edited by Prof. Karl Pearson, and Clifford's "Dynamic," edited by Prof. Tucker. Euler's formulas and De Moivre's theorem, so puzzling to the beginner, are here shown to be merely symbolic expressions of common sense facts, and diagrams are used to illustrate graphically the meaning of the complex imaginary number. Considering that this work of Clifford's was done almost a quarter of a century ago, it appears most wonderful how few of the crumbs from the table of this rich genius have been appropriated by the scientific world at large. The human mind is apt to unconsciously ignore the work of its predecessors and to consider everything as new when it is first thrust upon its perception.

We said at the outset that the author's work requires no word of praise, and we only wish to say in conclusion that the work before us

is one deserving of most careful study, a mine of valuable information, one of those mines, it may be said, that will yield treasures to all who dig in them.

Directory of Electrical Societies, Etc.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Next meeting, Niagara Falls, N. Y., May 21-23, 1901.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Ottawa, Ont., June 19, 20 and 21, 1901.

NORTHWESTERN ELECTRICAL ASSOCIATION. Next meeting, Sheboygan, Wis., last week in June, 1901.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, New York, Oct. 9, 10 and 11, 1901.

ASSOCIATION OF THE EDISON ILLUMINATING COMPANIES. Next meeting, Sept. 10, 1901.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Niagara Falls, N. Y., September, 1901.

New Westinghouse Transformers.

The Manhattan Elevated Railroad Company has recently ordered a large number of Westinghouse transformers, known as type "O. D.," which are to be used for lighting the elevated railway passenger stations throughout the city of New York. These transformers are to be of 3.2-kw and 6.4-kw size.

Although this type of transformer is of relatively new design, they partake of all the distinctive characteristics which have marked the Westinghouse transformers for many years. A number of new details, however, are incorporated. A feature is the use of a surrounding body of oil, enclosed in a metal outer case. This oil is valuable both as a cooling medium and because it increases both the life of the insulation and the lightning resisting power of the transformer.

The coils are individually insulated and are spread apart at the ends in such a way as to secure the greatest possible heat radiating surface without in any way lowering the efficiency of the apparatus. The transformer has been given a considerable range of e. m. f. by winding it for two primary and three secondary voltages. Individual sections of the windings are supplied with terminal contacts which, by a simple change of connections, give a range of voltage covering all practical requirements. The secondary coils are wound with copper of square cross-section, which gives about 30 per cent more available cross-section than similar coils wound with round copper, thus reducing the loss due to the resistance of the windings.

Before this type of transformer was placed upon the market it was subjected to a series of the most thorough tests in order to remedy any possible defects in design or construction. The complete line of transformers was operated for nearly a year at twice their normal e. m. f. The insulation was subjected to tests in which the e. m. f. was raised to eight times the normal figure, and careful measurements were made of the iron losses, which showed that throughout this long period of experimental overloading the iron had undergone no deterioration, the method of treating the iron being thus proven to be entirely satisfactory.

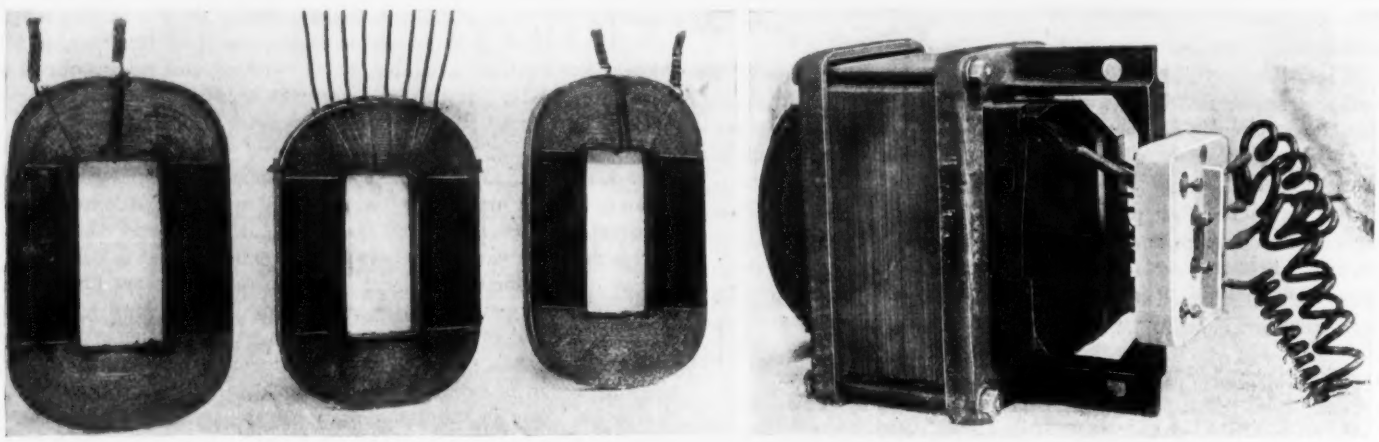


FIG. 1.—WESTINGHOUSE TRANSFORMER.

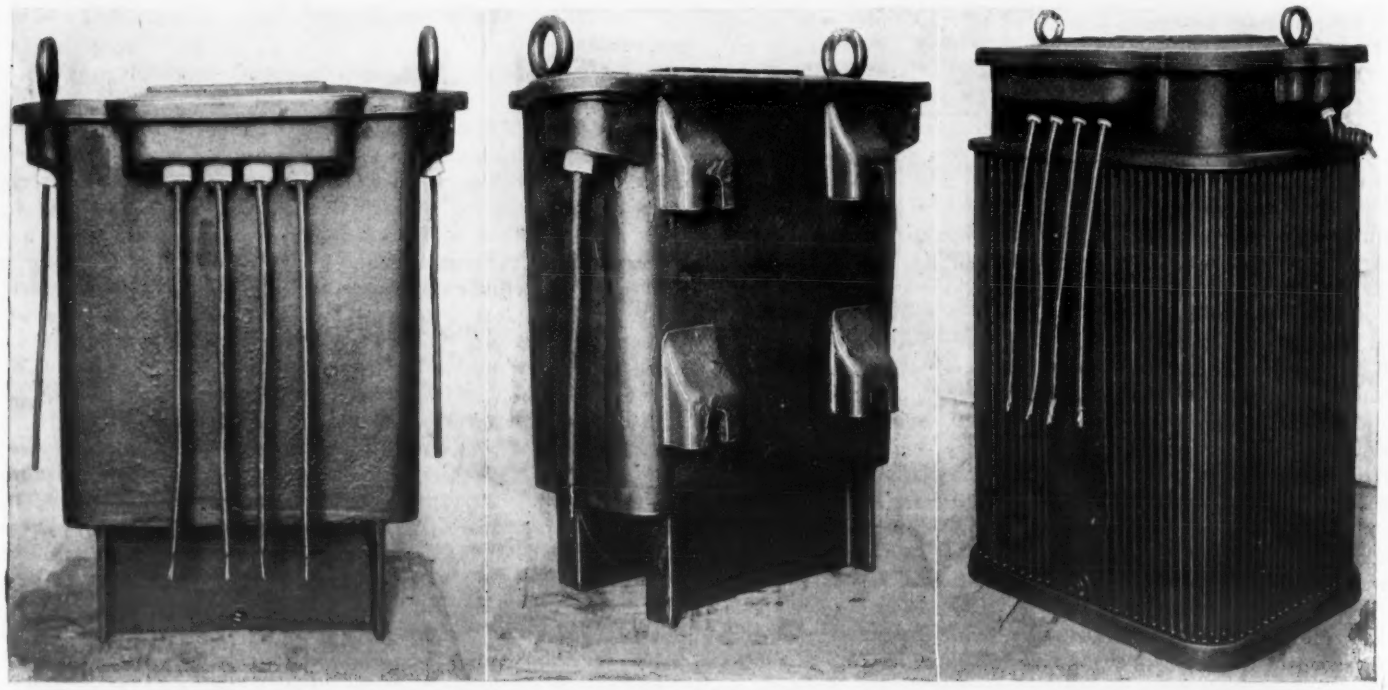
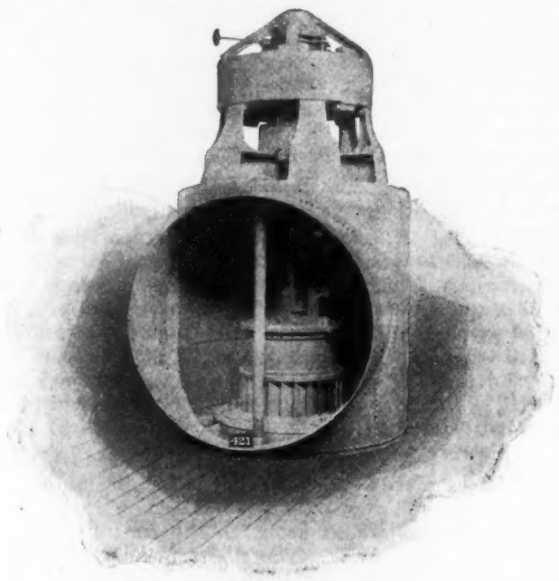


FIG. 2.—WESTINGHOUSE TRANSFORMER.

Every individual transformer before leaving the factory is run at overload with the normal potential at three times the normal voltage without load, and insulation tests are made at voltages ranging from four to eight thousand. Subsequently the coils are immersed in oil, which greatly increases their insulation resistance. These transformers may be wound for any e. m. f. up to 6600. They may be arranged for the Scott system of three-phase, two-phase transmission, and may be adapted to almost any special class of work. For capacities greater than 50 kw the Westinghouse Company manufactures a line of transformers known as the oil insulated self-cooling type. These self-cooling transformers are now being made in sizes up to 500 kw. The oil-insulated water-cooled transformers are being made in sizes up to 2250 kw, and the air-blast transformers in sizes up to 2750 kw.

Massachusetts Chemical Company's Water Power Plant.

The accompanying engraving shows a 33-inch cylinder gate Victor turbine, which was recently furnished to the Massachusetts Chemical Company, of Walpole, Mass. While there is nothing novel in the setting of the waterwheel, yet the combination of the waterwheel and the generator is something new in this country. The wheel operates under about 14-ft. head, developing about 115 hp, and running at about 150 r. p. m. The wheel is set in a steel flume with cast-iron heads, the water being conveyed to the flume by means of a steel feeder pipe. The flume stands on I beams across



CYLINDER GATE TURBINE.

the pit, with the customary draft-tube leading from the wheel to the tail water. Floor space in this particular case, however, was valuable, and for that reason the generator was mounted directly on top of the waterwheel shaft, the shaft through the armature being an extension of the waterwheel shaft. The generator is a Thresher direct-current machine.

The weight of the armature is carried by means of a thrust bearing, which is a combination of rings and pressure running in oil. This bearing is mounted on top of the flume cover immediately underneath the armature of the generator. The whole makes a very complete outfit, and the plan could be used to advantage in many places where light powers are to be developed. The designers and manufacturers were the Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio.

Drilling Machine with Turret.

The machine illustrated herewith is designed for drilling marble switchboards, and is made for overhead suspension in order to allow placing any size switchboard under it. The heads are held up in their usual position by a pin and spring. When the drill spindle is brought down it connects with the head under the drill spindle, and as the spindle goes down it unlocks the head from the cylinder and at the same time locks the head to the driver in the drill spindle, and remains locked until the spindle is carried back to its usual position, when it unlocks of itself and locks into the cylinder. The cylinder is turned by a slight touch and the next head stops exactly under the drill. When one of the heads is locked to the drill spindle it practically becomes a part thereof, and very little, if any, strain comes on the slides of the cylinder. It is not necessary to stop the machine in order to change drills. When the lever is raised it releases at once, and a slight touch brings into place another drill or countersink. Turrets of two to six heads or more can be fitted to this drill. The hole that is to be drilled and countersunk can be finished without moving the work. All the different sized holes can be drilled in the order in which they come, thus saving much time. Another advantage is that all the spindles in the turret can be fitted with drills of the same size, and when one becomes dull the next head is used, and so on until all are dulled, then one trip to the grindstone will do for all. For the largest work the turret can be taken off and a drill spindle used as a single spindle drill.

The turret heads illustrated have a run of 4 inches each, and swing in a 7-inch circle to the center of the spindle in the head, or 9 inches over all. The ends of the spindles can be fitted to a universal chuck, or bored out for straight or taper shank drills. This machine is manufactured by the George Burnham Company, Frank Reed, proprietor, Worcester, Mass.

DRILLING MACHINE.

Side Cutting and Splicing, and Insulated Pliers.

The Smith & Hemenway Company, 296 Broadway, New York, has placed on the market its No. 125 side cutting and splicing plier, shown in Fig. 1. This plier is made from Swedish electric boracic steel, and is especially adapted for linemen. One of its advantages is that it has a splicing clamp in the handle, which takes the place of a connector. It has round edges and polished head and jaws.

Fig. 2 shows the No. 118 insulated plier handled by the same company. The handles are rubber covered, thereby insulating them thoroughly and protecting the user from electric shock. Its round edge feature, it is stated, has met with much praise from electricians who have used the tool. It is convenient in size and can be carried in the pocket without injuring the clothes.

FIGS. 1 AND 2.—PLIERS.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The money market was quiet and easy; considerable Western money has been placed in the New York market. Time money is quoted at 3½ per cent for 60 to 90 days, and 3¼@4 for longer periods. Call money is quoted at 1¾ to 2½ per cent, 2 per cent being the prevailing rate. Commercial paper was dull, business being done on the basis of 3¾@4½ per cent for prime double names. In the stock market the predominating influence was the proposed combination of the Carnegie Company and other prominent steel manufacturing concerns. The preliminary incorporation of the United States Steel Corporation diverted speculative activity and attention to the industries, and heavy trading ensued in the stocks of the companies included in the deal. The dealings in railroad shares were not on a large scale, and outside participation was sensibly diminished. In tractions Brooklyn Rapid Transit was under pressure at one time, but rallied on the short interest. It is stated that the attack was based on rumors of friction between the company and its employees as a result of a report that the employees would be required to wear new khaki uniforms. The sales amounted to 80,507 shares, the closing price, 74¾, being 2 points lower than last week's closing. There was increased selling activity in Metropolitan Street Railway, but the price tended downward and closed at 161, a net loss of 1⅞ points. In the electrics General Electric was weak, closing at 210; a net loss of 3 points is recorded against this stock. The dealings in Western Union are dropping down to the normal, the total number of shares sold during the week being 8,550, closing at 86⅞, a net gain of ⅛. There was an unusual amount of activity in American District Telegraph, the number of shares changing hands having been 1300. The closing price was 37, which was a gain of 2 points over the close of the previous week. In the outside market the new steel stocks absorbed most of the attention. The appearance of these securities caused the most active market in the history of the curb. In the other stocks there was practically no change. A hopeful tone pervaded the market at the close of the week, and a general feeling prevailed that there would be a general advance in quotations during the coming week. The following are the closing quotations at the four cities named:

NEW YORK.

	Feb. 23.	Mar. 2.		Feb. 23.	Mar. 2.
General Electric	213	210	Elec. Veh.	14½	15
Bklyn Rap. Tran.	76¾	74¾	Elec. Veh., pfd.	30	30
Met. St. Ry.	162⅞	161	Gen. Car.	2¾	2¼
Am. Tel. & C.	—	94	Ill. Elec. Veh. Tran.	¾	⅞
West. Un. Tel.	86¾	86⅞	Hud. Riv. Tel.	117	120
Am. Dist. Tel.	35	37	N. E. Elec. Veh. Tran.	—	2¾
Com. Cable	—	160	N. Y. Elec. Veh. Tran.	4½	3¾
Elec. Boat	24	27	Tel. & Tel. Co. of Am.	4	4
Elec. Boat, pfd.	52	52	N. Y. & N. J. Tel.	175	180

BOSTON.

	Feb. 23.	Mar. 2.		Feb. 23.	Mar. 2.
New Eng. Tel.	—	135	Erie Tel.	57	50
Mex. Tel.	2⅝	2⅞	Gen. Elec., pfd.	175	—
Westing. Elec.	60	—	Am. Tel. & Tel.	161	158⅞
Westing. Elec., pfd.	—	—	Boston Elec. Light	212	—

PHILADELPHIA.

	Feb. 23.	Mar. 2.		Feb. 23.	Mar. 2.
Elec. Stor. Bat.	68	75½	Phil. Elec.	6¼	6¼
Elec. Stor. Bat., pfd.	68	75½	Pa. Elec. Veh.	—	1½
Elec. Co. of Am.	—	8¾	Pa. Elec. Veh., pfd.	—	1
Gen. Elec. Auto.	—	—	Am. Rys.	—	33½

CHICAGO.

	Feb. 23.	Mar. 2.		Feb. 23.	Mar. 2.
Chicago Edison	150	150	Chicago Telep Co.	260	260
Chic. City Ry.	255	255	Union Traction.	13¾	14
Nat'l Carbon	17	16	Union Traction, pfd.	53	56
Nat'l Carbon, pfd.	83	82	Northwest. Elev. Com.	34	36

THE COMMERCIAL CABLE COMPANY reports that the revenue from submarine cables and land lines increased $339,946 over the previous year. A sum of $350,000 was set aside as an addition to the reserve fund, $150,000 to the fund for insurance of stations, etc., and $400,000 to the reserve for renewal of land lines. After providing for operating expenses and reserve, the balance of said revenue, including amount brought forward from the previous year, amounts to $2,007,730, out of which have been paid interest on bonds and debenture stock and dividends of 8 per cent on the capital stock, leaving a balance of $221,066 to be carried forward to the present year. The share capital of the company has been increased from $10,000,000 to $15,000,000, and of the increase $3,333,300 was issued to shareholders at par to provide for extensions. The board of directors has been re-elected.

NEW YORK & NEW JERSEY TELEPHONE.—The annual report of the New York & New Jersey Telephone Company for the year ended Dec. 31, 1900, shows:

	1900.	1899.	Changes.
Gross	$2,827,481	$2,381,368	Inc. $446,112
Op. exp.	2,018,603	1,618,191	Inc. 400,411
Net	$808,877	$763,177	Inc. $45,700
Int., tax. and divs.	665,381	540,406	Inc. 124,974
Surplus	$143,496	$222,770	Dec. $79,273
Prev. sur.	1,933,112	1,710,342	Inc. 222,770
Total surplus.	$2,076,609	$1,933,112	Inc. $143,497

At a special meeting of the stockholders of the company held last week it was voted to increase the capital stock of the corporation from the present amount, $8,000,000, to $15,000,000. The increase of capital will be devoted to the enlargement and improvement of the plant of the company. The new stock, it was stated, would be offered to the present shareholders from time to time in such amounts as may be needed in construction requirements.

AMERICAN STEEL & WIRE.—The officers elected at the annual directors' meeting of the American Steel & Wire Company were as follows: J. W. Gates, chairman; William P. Palmer, president; William Edenborn, first vice-president; J. S. Keefe, second vice-president; P. W. Moen, third vice-president; S. H. Chisholm, fourth vice-president; F. L. Watson, treasurer; T. P. Alder, assistant treasurer, New York; A. F. Allen, assistant treasurer, Chicago; C. S. Roberts, secretary; F. E. Patterson, assistant secretary, New York; A. F. Allen, assistant secretary, Chicago; C. A. Honecker, auditor; C. A. Vogt, assistant aduitor; Max Pam, general counsel.

WESTERN UNION.—An operator interested in Western Union says: "Arrangements were made some little time ago with the idea of putting Western Union to the neighborhood of par. The stock was carried above 90. The market began to be unfavorable and it was decided to suspend operations. Recently an operator identified with the bull move has been absent from the Street and this has led to selling and a lower price. The general plan, however, is unchanged, and when the market is again right, there will be at least an effort to bull Western Union."

NEW JERSEY.—The Traction & Light Company, authorized capital of $4,000,000, has been incorporated to manufacture light, heat and fuel; to do a transportation business in New Jersey, not requiring condemnation of property, and to construct and operate railroads outside of the State. The stock is divided into $1,000,000 first and $1,000,000 second preferred, each with 4 per cent noncumulative dividends. The rest of the stock is common. The incorporators are Samuel Thomas and Samuel B. Lawrence, New York; James C. Young, Jersey City.

THE STEEL CONSOLIDATION, or the United States Steel Corporation (as the new concern is called), is to have a capital of $1,100,000,000, made up of $300,000,000 5 per cent bonds, $400,000,000 7 per cent cumulative preferred stock, and $400,000,000 common stock, and it would seem that there are besides outstanding $26,500,000 of what may be called underlying bonds. It includes American Steel & Wire and National Tube, but the American Bridge Company is not a part of it.

GENERAL ELECTRIC directors will presumably meet for dividend early this month. It is expected that they will declare something better than 2 per cent for the quarter. The last dividend was 3 per cent in December, "making 8 per cent for the year." The company is earning well over 25 per cent on the stock at present, and its business is the largest in its history.

TELEGRAPH, TELEPHONE & CABLE.—The acceptance by Randal Morgan, of the Widener-Elkins-Dolan syndicate of a place in the Telephone, Telegraph & Cable Company's board, is interesting as apparently showing that the syndicate will now have representation in the management of the Latta Company.

COLUMBUS EDISON.—The stockholders of the Columbus Edison Company are offered the right to subscribe for 6¼ per cent of additional preferred stock at par. The proceeds of the sale, $47,000, are to be used in enlarging the company's stations.

DIVIDENDS.—The Alley Elevated, Chicago, has declared the regular dividend of ¾ of 1 per cent, payable March 31. Books close March 20 and reopen April 1.

Commercial Intelligence.

THE WEEK IN TRADE.—The reports of trade conditions received by the mercantile agencies last week indicate general improvement and activity, and the future outlook is regarded as hopeful. Some "soft spots" are found, of course, *Bradstreet's* says, notably in the manufacturing branches of the cotton and wool trade, but advices from other kindred lines are encouraging. As to distribution, the best reports come from the West and Southwest. Trade on the Pacific Coast continues good, although rains have interfered with it somewhat in California, while at the same time helping the already good crop prospects. In the Northwest cold weather has somewhat retarded spring trade preparations, but the conditions are, on the whole, as satisfactory as those of a year ago. The iron and steel market exhibited quite a boom and steady advances are noted. It is thought that the broad and strong consumptive demand, and not the operation of pools or cliques, is responsible for the advances. Practically all the markets report iron and steel higher. The situation in textile manufacturing is unchanged, and the same applies to cereals. The gross earnings of 60 railroads for the third week of February show a gain of 8 per cent over a year ago. The business failures of last week, as reported by *Bradstreet's*, number 177, as against 221 the week previous, 173 the same week last year, 170 in 1899, 232 in 1898 and 262 in 1897. Copper during the week was dull and prices remain unchanged. The aggregate amount of business for home consumption was rather meagre. Quotations are 17c. for Lake Superior ingot and 16⅝c. for electrolytic and casting stock. There is very little demand for export, business in Europe being extremely dull, particularly in Germany. In the machinery market satisfactory conditions prevailed, and while there were few orders of magnitude, the balance shows very favorably, since small orders were numerous. On the whole the market is very satisfactory.

THE SPRAGUE ELECTRIC COMPANY reports an increase of sales over the corresponding month last year. The outlook for this year is exceedingly bright. Among recent orders are: One 75-hp and 4 30-hp motors for the Cooke Locomotive & Machine Company, Paterson, N. J.; 35 motors for the Central Lard Company, New York, who placed the order through their electrical engineers, Messrs. Floy & Carpenter; one 400-kw generator, one 125-kw generator, one 100-hp motor and six 80-hp motors in addition to a number of small motors for the Wellston Portland Cement Company; an order placed by Mr. George Hill, of New York, for the Dunmore Iron & Steel Company, Dunmore, Pa., consisting of one 62½-kw generator, one 100-kw generator and 25 motors of assorted sizes; one 75-kw generator, one 25-hp and one 30-hp motor for the National Distilling Company, Milwaukee; one 125-kw generator for the Big Muddy Coal & Iron Company, Murphysboro, Ill.; one 100-kw generator for the Keystone Leather Company, Camden, N. J. 17 motors for the Norfolk Navy Yard; one 50-kw and one 75-kw engine type generator for the new Windsor Arcade Building, New York; two 75-kw engine type generators for the new city prison, Blackwell's Island; two 100-kw engine type generators for the Manhattan State Hospital, Central Islip, and two 300-kw, 500-volt street railway generators for the Central States Construction Company, Chicago.

KEYSTONE STATE TELEPHONE & TELEGRAPH COMPANY has been incorporated under the laws of the State of New Jersey, with a capital of $2,000,000, and has made an arrangement with the Keystone Telephone Company to handle all of its toll line and long-distance business. The officers of the Keystone State Telephone & Telegraph Company are as follows: C. E. Wilson, president; W. W. Wharton, secretary and treasurer. The directors are: W. H. Clark, C. E. Wilson, Edward Foerderer, George Kessler, Norman Grey. The present offices of the company are in suite No. 750, Drexel Building, Philadelphia. They will probably remove to the Keystone Telephone Company's building at Second and Sansom Streets early in May. The Keystone Telephone Company is progressing very rapidly with the work on its new exchanges. It has secured properties for the two main exchanges, purchased the ducts formerly owned by the Standard Telephone Company, has purchased conduit and will let contracts for switchboard during the present week. The contracts for constructing the subway work will be let within 10 days. The management reports that it is much gratified with the way contracts for service are coming in.

WESTERN TELEPHONE CONSTRUCTION COMPANY.—Owing to the large increase of subscribers the new Corsicana, Tex., Telephone Company has ordered additional telephones and another section of multiple central switchboard from the Western Telephone Construction Company, of Chicago. In addition to the central battery equipments recently furnished Pottsville and Williamsport, Pa., and Corsicana, the same type of multiple equipment is being made by the Western for exchanges at Greensboro, N. C., and Binghampton, N. Y. Western "Express" switchboards of 100 lines capacity have been furnished the Shamokin Valley Telephone Company (increase), Northumberland, Pa.; Sebree (Ky.) Telephone Company (including large shipments of telephones), Jameson (Md.) Telephone Company, John Bringman, Taylorsville, Ind.; Washington (Iowa) Telephone Company; J. W. Sparks, Giddings, Texas (including telephones), and numerous smaller orders for other points.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, Pa., has recently closed a contract with the United Electric Light & Power Company of Baltimore, Md., for the installation of a battery of chloride accumulators consisting of 132 elements, having a capacity of 1200 ampere-hours, and with tanks allowing an ultimate increase by additional plates to a capacity of 2100 ampere-hours. The battery is located 5000 ft. from the power house and is to be operated in connection with two boosters having a capacity of 500 amperes at 35 volts. This battery is for the purpose of furnishing light and power to the Continental Trust Building and the Merchant Bank Building. The current is furnished from the power house at 220 volts and as it is intended to use 110-volt lamps and 220-volt elevator motors, a third wire will be taken from the centre of the battery to form the neutral of the 220-volt three-wire system. The two constant current boosters will be used on the outside wires for regulating the elevator load.

SALES OF BULLOCK APPARATUS.—The following sales are reported by the Bullock Electric Manufacturing Company: Glasgow *Evening News*, Glasgow, Scotland, three motor generators; London *Daily Express*, London, Eng., three motor generators; Montreal Water & Power Company, Montreal, Can., one 400-hp three-phase motor; Aberdeen *Journal*, Scotland, one 30-hp teaser equipment and one motor generator; Carnegie Steel Co., Pittsburg, Pa., one 25-hp type H motor; Greuner & Co., Johnstown, Pa., one 30-kw type I generator; Brown & Sharp, Providence, R. I., four type N motors for direct connection to machine tools; Wier Frog Company, Cincinnati, Ohio, three 10-hp type N motors; Pullman Company, Pullman, Ill., two 150-kw type H generators; Mosler Safe Company, Hamilton, Ohio, one 50-hp type H motor; Susquehanna Valley Electric Company, Sidney, N. Y., one 65-kw single-phase generator; Central Lard Company, New York City, N. Y., one 65-kw engine type generator; Buffalo *Evening News*, Buffalo, N. Y., one 70-hp type H motor.

THE CLARK AUTOMATIC SWITCHBOARD COMPANY, 938 Banigan Building, Providence, R. I., through its engineer, Mr. J. L. Putnam, has just installed at the establishment of the Walther-Robertson Drug Company, Pittsburg, Pa., a 12-point station automatically connecting several floors of its building with the main office. In addition to this other systems have been installed at the Union Wadding Company's works, at Pawtucket, R. I., comprising an 18-point plant, and another of 8 points has been placed in the office of L. C. Page & Co., publishers, in Boston. The last two as well as the first represent some of the most recent work of the Clark Company, which is having much success in having its automatic telephone system installed in a number of places.

THE MAXWELL M. MAYER ELECTRIC COMPANY, of New York City, reports the following sales for the month: One 2-hp motor, Standard Dairy Company, city; one 30-light dynamo, Appomattox Iron Works, Petersburg, Va.; one 1-hp motor, Bonner Sons, city; one 1-hp motor, Morton & Hover, city; three 50-light dynamos, Pernambuco, Brazil; one 5-volt, 500-ampere testing dynamo, Cutler-Hammer Manufacturing Company, Westfield, N. J., factory; one 10-hp motor, Birmingham, England.

DODGE MANUFACTURING COMPANY, of Mishawaka, Ind., has let plans for machine shop extension 185 ft. long by 120 ft. wide, and foundry extension 185 by 127 ft. In each building a 25-ton, 4-motor electric traveling crane, with 5-ton auxiliary hoist, will be installed. A 28 by 48 Corliss engine for the main power plant will be purchased. This company will also buy one or two generators. All these orders are now being placed.

BALL ENGINE ORDERS.—The Ball Engine Company, Erie, Pa., has recently installed two direct-connected self-oiling engines, one of 150 hp and one of 100 hp, in the Pittsburg Bank for Savings building, Pittsburg. The St. Vincent's Arch Abbey, Beatty Station, Pa., has recently installed an electric plant. The engines were built by the Ball Company, and are two 125-hp direct connected.

THE NORTHERN ENGINEERING WORKS, crane builders, Detroit, Mich., has recently installed in the Newburg plant of the American Steel & Wire Company, Cleveland, a special double trolley, 3-motor, 5-ton electric traveling crane, 51-ft. span.

TRAIN LIGHTING.—The New York Central, which has been experimenting with the axle-light system for lighting cars, will shortly equip 14 more cars with this system.

MAGNETIC SEPARATORS.—We have an inquiry from France for magnetic separators for a South American mine, and shall be glad to receive catalogues and price lists to be forwarded.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week ended Feb. 13: Antwerp—2 packages electrical material, $143. Argentine Republic—36 packages electrical material, $3,351; 3 cases electrical machinery, $332. British Australia—167 packages electrical material, $8,673; 48 packages electric car material, $9,917; 12 packages electrical machinery, $1,770. Bremen—4 packages electrical material, $401. Barcelona—8 cases electrical material, $566. British Possessions in Africa—1 package electrical machinery, $23; 1002 packages electrical material, $35,090. British East Indies—19 packages electrical material, $500. Bilbao—1 case electrical material, $30. British West Indies—57 cases electrical material, $2,403; 2 coils cable, $968; 6 cases electric motors, $227. China—12 bundles electrical material, $505. Cork—20 packages motor trucks, $1,300. Central America—212 cases electrical material, $501. Cuba—88 cases electrical material, $2,339; 6 packages electrical machinery, $550. Ecuador—1 case electrical material, $23. Florence—5 cases electrical machinery, $366. Glasgow—49 packages electrical material, $475; 8 cases electrical machinery, $1,600. Genoa—120 packages electrical material, $12,658. Gibraltar—5 cases electrical material, $115. Hamburg—35 packages electrical material, $5,657. Havre—39 packages electrical machinery, $1,936; 2 packages electrical machinery, $36. Japan—174 cases electrical material, $35,143; 24 cases electrical machinery, $6,665; 44 cases motors and parts, $3,528. Korea—45 packages electrical machinery, $4,735; 102 packages electrical material, $14,153. London—73 packages electrical machinery, $7,051; 374 packages electrical material, $38,942; 28 packages motor vehicles and parts, $14,075. Liverpool—69 packages electrical machinery, $3,689; 63 packages electrical material, $21,267. Mexico—96 packages electrical material, $2,153. Manchester—13 cases electrical material, $2,680. Madrid—2 packages electrical material, $67. Milan—33 packages electrical material, $2,400. Marseilles—2 cases electrical material, $225; 44 bales electrical machinery, $385. Naples—1 case electrical material, $719. Philippines—12 cases electrical material, $1,388. Reval—30 cases electric fans, $403. Southampton—11 cases electrical material, $800. Siam—3 cases electrical material, $329. St. Petersburg—22 cases electrical material, $251. San Domingo—8 packages electrical material, $891. Tasmania—4 packages electrical material, $94. United States of Colombia—4 cases electrical goods, $59.

THE GERMAN WESTINGHOUSE COMPANY.—The Westinghouse Electric & Manufacturing Company, through the Westinghouse Electric Company, Ltd., of London, has recently caused a company to be organized in Germany, known as the Westinghouse Electricitäts Aktiengesellschaft, with a capital of 1,000,000 marks, for the purpose of selling the apparatus of the Westinghouse Electric & Manufacturing Company. Felix Singer has been appointed a member of the vorstand, or managing board, the officers being as follows: President, Lemuel Bannister; vice-president, W. E. Smith; managing directors, Felix Singer and F. Hessenberg; supervising board, Lemuel Bannister, Ph. Ferd. Kobbé, W. E. Smith, Otto Müller, Arthur Führ. The company's main office is at 19 Jägerstrasse, Berlin, and it will represent the Westinghouse interests in Germany, Austria, Hungary, the Balkan States, Turkey in Europe, Turkey in Asia, and Greece. It is understood that it was organized as the most convenient way for exploiting in Germany and the other countries named the business of the Westinghouse Electric & Manufacturing Company, which already promises to be of magnitude in those countries.

THE OTIS ELEVATOR COMPANY, of New York City, reports a steadily increasing foreign demand for electric elevators, which are being shipped to various parts of the globe. Recent contracts call for the installation of elevator equipments in the Government railway offices in Wellington, New Zealand; the palace and presidential offices of President Diaz of Mexico, and the residence of the Viceroy of India at Calcutta. Among the foreign hotels about to be equipped with electric passenger elevators are the Hotel de Orange, at Spa, and the Hotel Royal de Belge, at Ostend, Belgium. Japan is also a customer, a large equipment having been ordered through Takata & Company, of 10 Wall Street, for the offices of the Nippon Insurance Company, of Kobe, Japan, while the Japanese banking offices of Mitsui & Company will also be furnished with American electric elevators. Other orders lately obtained include equipments for the Bazaar Wertheim, one of the large department stores in Berlin; a hospital in Calcutta, India, and a large office building in Madrid, Spain, while shipments have been made during the last 10 days to Rostoff-on-Don, Russia; Cape Town, South Africa; Colombo, Ceylon; Shanghai, China, and Perth, Western Australia.

THE ST. LOUIS CAR COMPANY has opened New York offices in the Taylor Building, 39-41 Cortlandt Street, under the management of Edward D. Floyd & Co., which concern will handle all business secured in New York, New Jersey, Delaware and the eastern portions of Connecticut and Pennsylvania. The company is making a serious bid for the export trade and is shipping several cars abroad, principally to Great Britain and Germany. The cars intended for England are forwarded "knocked down." A. K. Baylor, of St. Swithin's Lane, London, E. C., whose New York offices are located in the Bowling Green Building, has formed a company for the purpose of erecting a plant on the other side, where the cars will be assembled.

TROLLEYS FOR NEW ZEALAND.—Consul Dillingham writes from Auckland, Jan. 2, 1901: "For more than three years Auckland has discussed the advisability of introducing an electric tramway system. Several contracts have been granted to local firms and to London syndicates, but the change has not been made. A New York company has now arranged to build the road. Rails, cars and other material will be brought from America, as well as a force of men to equip and put it into operation. The cost of the line will be about $1,000,000.

TROLLEY CAR BUILDING.—A special dispatch from Newburyport, Mass., of March 2 says: "Representatives of New York capitalists have been making a canvass of the electric railway car manufacturing plants in New England with a view of securing control and consolidating the industry. With the proposed building of a large number of electric roads in New England the coming summer, the promoters look upon the great demand for cars as a prospect of big profits in this industry. It is said that a number of the companies have given options on their plants."

ENLARGEMENT OF PLANT.—Work is now progressing on the new addition, 90 by 220 ft., of the James Leffel & Co.'s plant, Springfield, Ohio, to be built of brick and steel, and equipped with electrical cranes and a number of new machines to enable them to supply the increased growing demand for their Samson wheels. These works will now give work for 300 men. This company has just received an order for a large pair of horizontal wheels from Minneapolis to develop 3000 hp, and another contract for 10 68-inch Samson wheels from Michigan for driving electrical machinery.

THE NATIONAL CONDUIT AND CABLE COMPANY'S new wire plant at Hastings-on-Hudson will begin working operations within the next 10 days. The plant, which entailed an expenditure of over $400,000, will have an annual capacity of 100,000,000 lbs. It is said to be the largest strictly copper wire plant in the world. The National Company's recent foreign business includes contracts for the supply of conduit to be utilized on the Newcastle-on-Tyne and Island of Thanet electric railroads, England.

THE MOUNT LAKE RAILWAY COMPANY, of Gloversville, N. Y., is at present purchasing some of its equipment, etc. It has closed a contract through Edward D. Floyd & Co., of New York City, for the furnishing of seven trolley cars and trucks, which will be built by the St. Louis Car Company, of St. Louis, Mo. The order for the electric equipment is not yet placed. The Washington Company, New York City, of which John G. Wright is secretary, has obtained the contract for the power house and its equipment.

THE KRAWJEWSKI-PESANT COMPANY, of 32 Broadway, New York City, is placing important orders for long-distance telephone equipments requisitioned for by the United States Government for shipment to Cuba. The Western Electric Company is said to be receiving fair-sized orders for telephones, insulators, brackets, etc., while the American Steel & Wire Company is securing a number of orders for telephone wire.

FIRE.—The Thresher Electric Company, of Dayton, Ohio, was burned out last week. The Thresher Company sustained a loss of about $25,000; the insurance is $22,450. The company was at the time at work on a large contract for electrical equipment for the Government.

THE PITTSBURG BOILER SCALE RESOLVENT COMPANY, Park Building, Pittsburg, Pa., has received an order from the Government for a quantity of its boiler scale resolvent, to be used in the boilers of the United States ice machine plant, Iloilo, Philippine Islands.

WESTINGHOUSE GENERATOR.—The Cleveland office of the Westinghouse Electric & Manufacturing Company has closed a contract to furnish the Cleveland Hardware Company with a 75-kw two-phase 720 r. p. m. generator for a new power house now building. The hardware company will operate its plant by electricity.

MR. JOAQUIN MAIZ, a large owner of lead and copper mines at Monterey, Mexico, is visiting New York City and staying for a time at the Waldorf. He is very much interested in the question of electric power and the transportation of his ore, and would, if possible, like to apply electrolytic or electric smelting methods.

PHILIP LESERMAN, whose New York offices are in the Havemeyer Building, is about to place some substantial contracts for electrical machinery required by various South African water power plants.

THE BRIDGETOWN CRYSTAL ICE COMPANY, of Bridgetown, Barbados, is about to install an electric light equipment in its ice-making plant.

Special Correspondence.

ENGLISH NOTES.

LONDON OFFICE OF ELECTRICAL WORLD AND ENGINEER,
Feb. 23, 1901.

THE BIOGRAPH AND THE QUEEN'S FUNERAL.—From a spot apparently close to St. George's Hospital an excellent biograph picture of the funeral procession was obtained, and this, giving a vivid impression of the scene, will be appreciated by many thousands who were unable to obtain a view of the mournful pageant itself. The picture was shown, for the first time, at the Royal Aquarium, and it made a profound impression on the large number of spectators, who stood, bareheaded, to see it, while the orchestra played the "Dead March in Saul."

THE QUEEN'S DEATH AND CABLING RECORDS.—The important news which culminated in the Queen's death caused a rush of work to the cable companies. Of course, the great American newspapers made the greatest demand for news. The Commercial Cable alone carried 25,000 words in description of the funeral to American newspapers. Its best previous record was 13,000, made during the Jubilee. The French Cable carried close to 20,000 words, while the Western Union Telegraph Company transmitted 15,000. The New York *Journal* alone received 16,000 words from London. Each word cost the newspaper receiving it 5d.

THE X-RAYS AT LADYSMITH.—At a meeting of the Roentgen Society held recently at 20 Hanover Square, a paper by Lieut. F. Bruce, R. A. M. C., on "Experiences of X-Ray Work during the Siege of Ladysmith" was read. He pointed out that Ladysmith afforded the first instance in which such work had been carried out under shell fire. There was little trouble about the apparatus itself, but the supply of electricity was not so easy a matter, since the town was not installed with the electric light. He had no faith in the system of driving a dynamo by a man on a bicycle, for the process of charging six cells in that way was like climbing a very steep hill; still he took a dynamo with him. In addition to the storage cells which formed part of his equipment, he applied for some of the large cells which he noticed were used for lighting the train by which he traveled. In Ladysmith two small rooms in the town hall were set aside for X-ray work, and one of them was fitted up as a photographic dark room. The battle of Elandslaagte furnished the first cases; in these, while there was much bone-splitting, there were few cases of embedded bullets, though in those that did occur they were successfully localized. When the Boers cut off the main water supply there was a scarcity of water for washing the plates, and what there was available was exceedingly dirty. Later fighting yielded many cases, and as the supply of electricity was giving out it became necessary to do something to get the batteries recharged. This was managed at a flour mill near the town hall, the dynamo brought by Lieut. Bruce being attached to the mill shafting. The arrangement worked well, the current obtained supplying electric light to the operating room by night, besides charging the cells. On Nov. 5 they had to move across the Klip, owing to attentions from Boer shells. The wagon stuck in the middle of the river, and when they did arrive at Intombi, their destination, there were no tents available for them, and their apparatus had to lie on the bare ground for two days until the tent came. Later, they were ordered back to Ladysmith, in case the relieving columns arrived. The battle of Jan. 6 showed some interesting cases, apparently due to the use of explosive bullets by the Boers. The X-rays were employed in all in some 200 cases, nearly half being photographed, and the apparatus proved itself of great advantage. As to improvements suggested by his experience, Lieut. Bruce thought a properly constructed operating table was required, in which, if desirable, the photograph could be taken from below. But the generation of electricity was the chief point, and he was of the opinion that for field use an outfit could not be considered as complete unless it had its own machinery for the production of electricity. He suggested that an oil motor, like those used on motor tricycles, might be provided to drive the dynamo.

General News.

THE TELEPHONE.

NORTH BEND, NEB.—The Farmers' Telephone Company has been incorporated here with a capital stock of $20,000.

ALEXANDRIA, IND.—The City Council has granted a franchise for a new telephone system to a company headed by L. C. Nieason.

MARION, IND.—The Central Union Telephone Company will put in a rural telephone system. The farmers propose helping to build the lines.

NEW HOPE, KY.—The New Hope Telephone Company is equipped with Farr apparatus and has 53 subscribers. Mr. F. W. Hagan is secretary.

BIRMINGHAM, ALA.—The magnificent system of telephones installed here by the People's Telephone Company is being put in operation and will soon be doing business.

JEFFERSON CITY, MO.—The bill providing for the taxation of telephone companies in the same manner as telegraph companies are now taxed has been favorably reported.

FAIRFAX, MO.—The Fairfax Telephone Exchange Company has in contemplation the erection of some toll lines. It is enjoying a good business and is using Stoddard apparatus. It has a switchboard capacity of 100 drops and has 40 subscribers.

LOUISVILLE, KY.—The Cumberland Telephone & Telegraph Company and the Cincinnati Telephone Company have agreed to build connecting lines between Cincinnati and other Southern cities. The Cincinnati company is to build 300 miles at once.

DAYTON, OHIO.—The franchise application brought by the Home Telephone Company before the Probate Court has been dismissed on the motion of the company itself. It is believed the city is now willing to come to satisfactory terms with the company.

LE SUEUR, MINN.—The Le Sueur Telephone Company is operating a switchboard of 100-drop capacity. The apparatus used is that of the American Electric Telephone Company. The company now has 60 subscribers and is expecting an addition of 20 more.

INDIANAPOLIS, IND.—The New Telephone Company will construct new lines from this city to Logansport, Shelbyville and Greensburg; Greencastle and Terre Haute and Greencastle and Rockville. The company has placed an order for $37,000 worth of copper wire.

KOKOMO, IND.—W. N. Turner and C. A. Jay, of the Independent Telephone Company of this city, have made application to the City Council of Logansport and the commissioners of Cass County for franchises for a long-distance telephone connecting Logansport and Kokomo.

CHARLOTTE, N. C.—It is stated on what is claimed to be good authority that the Southern Bell Telephone Company contemplates extensive improvements during the present year, for the purpose of heading off competition which already exists to a large extent in several of the Southern States.

PINCKNEYVILLE, ILL.—A meeting of the Independent Telephone Association of Southern Illinois was held March 5. Both the Bell and Kinloch long-distance companies have submitted propositions to the association for securing long-distance connections for the various companies forming the association.

TERRE HAUTE, IND.—The Citizens' Telephone Company, of this city, which recently began extending its system throughout the city and country, is meeting competition from the Central Union Company. The latter is planning to extend its service, and the liveliest competition in all quarters is anticipated.

SAN FRANCISCO, CALIF.—The Postal Telegraph Company has just completed a new line from Albuquerque, N. M., to Bakersfield, Calif. The Pacific States Telephone & Telegraph Company is also running a loop on the same pole line. The Postal Company has just laid a new cable from Goat Island in San Francisco Bay to Oakland, Calif.

SPARTANBURG, S. C.—The Spartanburg Telephone Exchange has a switchboard capacity of 600 drops and 450 subscribers. It is a rapidly growing concern, the plant and its capacity having been greatly enlarged recently. A direct connection with Asheville is projected. The company is using the apparatus of the Telephone Manufacturing Company.

KENTLAND, IND.—Mr. Wm. K. McCray is the owner of the Home Telephone Exchange in this place. The exchange has a switchboard capacity of 200 drops, 160 of which are installed. There are 175 subscribers, of which 25 are new-comers. The exchange is operating a toll line to Fowler. The apparatus used is that of the Sterling Electric Company.

SYDNEY, IA.—The City Telephone Company has stations at Sydney, Tabor, Randolph, Henderson, Malvern, Anderson, Silver City and Hastings. It has 300 subscribers and is using American Electric and Victor apparatus. The company expects to increase the number of subscribers during the present year between 200 and 300 and to install 200 instruments during March.

AUSTIN, TEX.—A bill has been introduced in the House of the Texas legislature providing that all telegraph and telephone companies shall in the future be placed under the authority of the Railroad Commission of Texas. This is done with a view to having rates established by the commission forcing these companies to keep general offices in the State and to submit their books to the commissioners for inspection.

SCALP LEVEL, PA.—The Salix Telephone Company, during the past year, placed 100 telephones in Windber and Scalp Level. It is operating two 100-drop boards and one 50-drop board and has 200 subscribers, the switchboards being made by the Western Telephone Construction Company and the Keystone Company. The company contemplates extensions to Center City, Loydell, Lovet, Rummel, and to 39 Eureka mines. Mr. C. S. Ickes is the manager.

ST. CHARLES, MO.—The telephone war between the Kinloch and Bell companies is becoming very interesting. At last week's Council meeting the Kinloch people were granted permission to erect poles in various parts of the city wherever they were asked for, and it is claimed that company will reconstruct the entire local system, thus giving equal service at much lower rates than the Bell. In retaliation the latter company is putting in residence telephones free the first year.

YORK, PA.—Representatives of the independent telephone companies of Pennsylvania, Maryland, Virginia and West Virginia have effected an agreement whereby a consolidation of all the companies will be made, with a capitalization of $2,000,000. The headquarters will be in this city. It is stated that they have made arrangements whereby they will begin a long-distance service to Philadelphia and New York through the Keystone Company of Philadelphia. They hope ultimately to unite with the independent telephone companies of the Western States.

NEW PHILADELPHIA, OHIO.—The Tuscarawas Home Telephone Company, New Philadelphia, Ohio, has exchanges at this place, Canal Dover, Uhrichsville, Dennison, New Comerstown and Mineral City, under separate organizations, which, however, will be merged into one company during the next 60 days. There are 464 subscribers in New Philadelphia, the total in all of the towns named being 1400. Mr. Geo. I. Hoffman, president, states that by Dec. 31 next he expects to have not less than 2000 subscribers. The company is using American Electric telephone apparatus.

LEBANON, IND.—The Lebanon Telephone Company has offered all Boone County patrons of the Farmers' Co-operative Telephone Company free service with any of its subscribers, and free service to their homes when in the city. The Co-operative Company demands that this offer be extended to all members of the co-operative system, irrespective of county lines, and that patrons of the Lebanon Company be granted free communication with the co-operative members. Unless this concession is made the co-operative company will put in a system in Lebanon if a franchise is granted.

INDIANAPOLIS, IND.—According to dispatches reaching this city, plans have matured for the formation of a combination of independent telephone inter-

ests. The dispatches say that two companies have been formed to effect a consolidation of all the short and independent lines in Indiana, Ohio, Michigan and Eastern Illinois. It is also said that an extension in Indiana will be constructed south from Mishawaka to connect with the Indianapolis independent lines, and that another extension will be built to Butler, Ind., connecting there with a line running into Cleveland, Ohio. By a wire to Chestertown, it is said a Chicago service can be had. The complete plans embrace connections between Cleveland, Indianapolis, Toledo, Detroit, Chicago and hundreds of smaller cities and towns in the four States concerned.

CINCINNATI, OHIO.—At the annual election of the City & Suburban Telegraph Association the following directors were elected: Henry Hanna, C. H. Kilgour, George Bullock, John Kilgour, C. Jay French and Capt. George N. Stone. Capt. Stone was re-elected president, C. W. Kilgour vice-president, John Kilgour treasurer, W. A. Blanchard secretary. Capt. Stone's annual report showed that during the year the company handled 231,071 messages, an average of 637 a day. There were 59,943 ft. of aerial cable strung during the year, equal to 718 miles. This makes a total of 4863 miles of metallic circuits on 520 miles of poles. In the underground system there are 345,475 ft. of cables, containing 6543 miles of conductors.

BUFFALO, N. Y.—The Queen City Telephone Company was incorporated last week with a capital stock of $500,000. It is to operate an independent telephone system in the city of Buffalo, connecting with the following other cities: Easterly to Rochester, Syracuse, Utica, Albany, Poughkeepsie and New York City; northeasterly to Tonawanda, Niagara Falls, Lockport, Oswego, Watertown and Ogdensburg; westerly to Dunkirk, Erie, Cleveland, Detroit, Toledo and Chicago, and southerly to Jamestown, Hornellsville, Binghamton, Corning, Elmira, Scranton, Wilkesbarre, Philadelphia, Jersey City and Washington. The directors are Hardin H. Littell, Robert R. Hefford, Frank H. Goodyear, Charles W. Goodyear, Robert F. Schelling and Eugene A. Georges of Buffalo, and Samuel E. Wayland of Scranton, Penn. As in Cleveland, some of the capital represented comes from the street railway field.

GLOUCESTER C. H., VA.—The Tidewater Telephone Company is now operating 226 miles of line and has a half interest in 19 miles of toll line and about 568 miles of wire, 2 exchanges and 137 stations, besides the public telephones used at the exchanges. The company is changing its system to full metallic circuits. Last year a very large growth was recorded. A metallic trunk line was built from Gloucester C. H. to Newport News, a distance of 32 miles, and various extensions were made in Gloucester. A half-mile of 4-conductor cable was laid between Gloucester Point and Yorktown. Several other improvements were made to the system, and there are many new applications for service. Nearly all of the lines are party lines, carrying from 2 to 12 stations. It is proposed to open an exchange at Matthews C. H. The company also proposes to build a metallic trunk line from Gloucester C. H. to Richmond, a distance of about 75 miles. For these improvements the company will issue $10,000 of stock. The standard Bell long-distance apparatus is used. Mr. L. C. Catlett is superintendent.

ELECTRIC LIGHT AND POWER.

DENTON, IND.—Application has been made to the Town Commissioners for an electric light franchise.

SHEBOYGAN, WIS.—The C. Reiss Coal Company is figuring on installing a complete electrical power and lighting plant.

HALIFAX, N. S.—The City Council has decided to at once install a municipal electric light plant at an estimated cost of $100,000.

ALBANY, GA.—The Albany electric light plant suffered loss by fire amounting to several hundred dollars on the night of Feb. 24.

THOMASTON, GA.—This town has voted $10,000 electric light bonds. It is stated that an electric light plant will be established at an early date.

BOLIVAR, MO.—In a special election here the proposition to increase the debt of the city $4,000 for a municipal electric light plant was carried.

THOMPSONVILLE, MICH.—The dam at the village electric plant has been destroyed by a flood, and the village will be in darkness for some time.

ST. JOHN, N. B.—The Manchester, Robertson & Allison Company has been incorporated here with a capital of $800,000 to supply electric light and power.

ST. LOUIS, MO.—The County Court has granted a franchise to the city of Kirkwood to erect poles and string wires for electric lighting certain territory surrounding that city.

CHILLICOTHE, MO.—The city of Chillicothe has sent a committee to visit Macon, Mo., to examine the municipal electric light plant there, with a view to establishing one here.

SACKVILLE, N. B.—It has been decided to enlarge the electric light plant of the town of Sackville, N. B. A brick power house will be erected and a new boiler and engine installed.

YORK, PA.—Application has been made to the City Council for a perpetual franchise by the Merchant's Electric Light, Heat & Power Company; capital, $100,000. C. H. Baer, president, York, Pa.

VAN BUREN, ARK.—The Van Buren electric light plant, owned by Johnson Brothers & Faulk, the railroad contractors of St. Elmo, Ill., was sold by them Feb. 27 to J. E. Powers of Van Buren.

WARRENTON, MO.—The Electric Company of Warrenton has been incorporated with a capital stock of $6,000. The incorporators are F. E. Schowengert, George Hillemeyer, R. H. Kemper and others.

SAN FRANCISCO, CALIF.—The San Francisco Electrical Works recently closed a contract for a switchboard and wiring of buildings at the Naval Training Station on Yerba Buena Island, in San Francisco Bay.

SAN FRANCISCO, CALIF.—The Truckee River General Electric Company recently paid its second monthly dividend at the rate of 10 cents per share on the capital stock. The company's plant is in Floriston, Calif.

VINCENNES, IND.—Mr. E. J. Julian has been appointed receiver of the City Electric Lighting Company of Vincennes. A recent reference to this appointment might lead to the erroneous impression that he was appointed receiver of the Vincennes Electric Light Company.

GRANTSBURG, WIS.—Eastern capital has been interested by business men in a plant to utilize the water power of the Kettle River Rapids, six miles from the village, and transmit the power to this and surrounding towns electrically. These rapids are 6 miles long and have a fall of 70 ft.

THE INDIANA ENGINEERS' ASSOCIATION held its annual meeting in Indianapolis recently. A paper was read by J. B. Nelson on "Municipal Control of Electric Light and Water Works Plants." Discussions were had on electric engineering and the comparative advantages of American and European electric railways were explained.

SAN FRANCISCO, CALIF.—The work of installing electric hoists in the mining shafts on the Comstock Lode in Nevada is steadily progressing. The work in the Belcher mine shaft is about done, and that in the C. & C. and the Union shafts about half completed. The Risdon Iron Works recently shipped the greater part of the hoisting machinery for the Yellow Jacket mine.

SPOKANE, WASH.—The Big Bend Light & Power Company has filed articles of incorporation and intends to furnish electric light and power to towns on the Central Washington branch of the Northern Pacific. Responsible capitalists are interested. The Spokane Electric Power people are also trying to get into the field with power furnished by Spokane Falls. There is a race for the prior establishment of systems.

DETROIT, MICH.—The St. Joseph & Elkhart Power Company has been incorporated with a capital stock of $100,000. The following officers have been elected: M. V. Beiger of Mishawaka, Ind., president; C. H. Tenney, New York, secretary; C. F. Hewitt, Elkhart, Ind., treasurer and general manager. The company will build a new power house and dam on the St. Joseph River, near here, and furnish electric power to adjoining towns.

PORTLAND, ORE.—The Portland General Electric Company is about to erect an auxiliary steam power generating station on the site of the old Union power station in the porthern part of this city. Contracts have been closed with the General Electric Company for a 750-kw three-phase generator and a 325-kw 500-volt street railway generator. The plant will be used in case of trouble from high water at the company's transmission plant in Oregon City.

PINE BLUFF, ARK.—The Board of Public Affairs Feb. 27 let to the Pine Bluff Traction Company a contract to do the city lighting for 15 years. The contract carries with it an agreement to build an electric street car line. The Pine Bluff Light & Water Company put in a lower bid, but would not build the car line. It will contest in the courts the awarding of the contract to its rival, which was organized by home people for the purpose of building the car line.

CHARLESTOWN, VA.—A movement is on foot in this place to organize an electric light company. The promoters of the enterprise are represented by Messrs. Chew and Norris, of this place. It is expected to have the plant in operation shortly, and electric light and power will be supplied to mills and factories in this and neighboring towns. The generating plant will be located on the Shenandoh River, where, it is stated, there is ample power for all the needs of the company. The company will need electrical and hydraulic apparatus.

COBURG, ONT.—At a recent meeting of the town council a by-law was passed granting a franchise for pole rights to the Central Ontario Power Company, of Peterboro, Ont., for the purpose of transmitting electric current from Burleigh Falls for lighting and power purposes. The Port Hope, Ont., town council has passed a similar by-law for the same purpose, as also all the intervening townships that lie between Port Hope and Burleigh Falls. The Crossen Car Manufacturing Company and the Dick Ridout woolen mills will be supplied with 500 electric horse-power and the town of Port Hope has arranged with two new manufacturing corporations to establish works in the town, the town furnishing the buildings. Mr. J. Alexander Culverwell, of Peterboro, is the managing director of the power company.

THE ELECTRIC RAILWAY.

BRESE, ILL.—An electric light plant will be established here.

INDIANAPOLIS, IND.—The Union Traction Company is establishing an express system over its interurban lines.

SANDUSKY, OHIO.—J. C. Parker, of Sand Hill, is promoting a new road to be known as the Sandusky, Clyde & Tiffin Electric Railway.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company has filed a franchise ordinance for various extensions and some new work.

FRANKFORT, KY.—The Shelby County Electric Power & Railway Company has been incorporated with $10,000 capital stock, with the privilege of increasing to $200,000.

NEWCASTLE, IND.—A. D. Ogborn and others have secured a franchise through Newcastle and Spieeland for an electric railway from Newcastle to Knightstown.

INDIANAPOLIS, IND.—The Indianapolis & Lebanon Traction Company has filed articles of incorporation. Capital stock, $400,000. William Helfenberg heads the board of directors.

TERRE HAUTE, IND.—As the result of a religious revival a man has sent 20 cents to the local company as conscience money, having ridden four times on the line without meeting the conductor.

CINCINNATI, OHIO.—The Cincinnati street railway system, with its franchises, rolling stock and all other rights and equipment, passed into the hands of the Widener-Elkins syndicate on Feb. 21.

PAINESVILLE, OHIO.—Messrs. Tuttle, Goodrich and Stanley, of Geneva, promoters of a line from Geneva to Meadville, Pa., have secured a franchise from Geneva to Painesville by way of Fairport.

TOLEDO, OHIO.—Joseph L. Yost and F. V. H. Collins, representing local capitalists, have applied to the Lucas County Commissioners for a franchise for a road to Holland and Swanton. The franchise will be granted.

NEWBURYPORT, MASS.—Fire destroyed the car sheds of the Georgetown, Rowley & Ipswich Street Railway. Twenty-one cars, three snow plows and many trucks and other equipments were also destroyed. The loss is $75,000.

CRESTLINE, OHIO.—The Cleveland, Elyria & Western interests and the Ohio Central Traction Company are rivals for a road from Galion to Crestline. The local council and the commissioners have advertised for propositions.

COLUMBUS, OHIO.—The Richmond, Marysville & Columbus Electric Railroad Company has been incorporated by F. V. Fullington, William King, R. L. Woodburn, John Hendrixon and N. E. Niggett. Temporary capital stock, $10,000.

INDIANOLA, IA.—The City Council has granted a franchise to the Des Moines & Indianola Railway to build a road from Des Moines to the army post and thence to Indianola. The ordinance will be voted on at an election on March 25.

AKRON, OHIO.—D. Davis, representing the local promoters of the Aurora, Wheatland & Chicago Railway, is placing contracts for the equipment of the road. A contract has been closed for 2000 horse-power of Edgemore boilers. S. Morse, of this city, is engineer for the road.

LAFAYETTE, IND.—The Lafayette, Purdue & Northern Railway Company has been incorporated. Detroit, Indiana and New York capital is said to be behind the scheme. The company has an option on the local railway system and will pay $500,000 for it and take possession April 1.

MANSFIELD, OHIO.—T. Y. McCray and J. F. Boles, promoters of the Mansfield, Mt. Gilead & Columbus Railroad, and the Mansfield, Savannah & Wellington Railroad, have announced that all rights of way have been secured and that grading will be started at once at several points.

LEXINGTON, KY.—The Blue Grass Rapid Transit Company, with a capital stock of $30,000, with privilege of increasing to $1,000,000, has filed papers of incorporation. Electric car lines will be built to Richmond, 26 miles; Winchester, 18; Paris, 18; Georgetown, 12; Versailles, 13; Midway, 12.

NORFOLK, VA.—An ordinance has been referred to the Councils, which, if passed, will require the Norfolk Railway & Light Company and the Norfolk & Atlantic Terminal Company to adopt a double-wire system instead of its single-wire trolley system, in order to prevent damage to water mains.

CAPE MAY, N. J.—Vice-Chancellor Reed has signed a decree ordering the sale of the Cape May, Delaware Bay & Sewell's Point Railroad Company, the trolley line along Cape May's beach front. This sale is made to satisfy the claims of the holders of the $300,000 of bonds of the company, on which interest has not been paid for some time.

CLEVELAND, OHIO.—The belief is expressed in Cleveland railway circles that Henry A. Everett is making an effort to secure control of the Cleveland City Railway Company, of which M. A. Hanna is president. If control of this company is secured, the much-talked-of consolidation of Cleveland interurban companies will probably be effected.

DETROIT, MICH.—The Wyandotte & Detroit River Electric Railway, running from Detroit to Trenton, was purchased from J. C. Hutchins of Detroit, A. B. Dupont of St. Louis and other owners, by the Detroit United Railway. President Everett says the new purchase will be consolidated with the United Railway Company and operated in the same way as the city lines.

THE NORTHWEST RAILWAY CLUB.—At the regular monthly meeting of the Northwest Railway Club, held at the West Hotel, Minneapolis, Minn., Feb. 13, a paper on "Electric Traction for Heavy Railway Service," read by Mr. E. P. Burch at the previous meeting, was discussed. Prof. Shepardson of the University of Minnesota gave a lecture on "The Principles of the Dynamo."

COLUMBUS, OHIO.—The Franklin County Commissioners have granted a 25-year franchise to the Columbus & Southern Railway Company. The Scioto Valley Traction Company, a rival road, has abandoned its efforts to secure a franchise in the county and has purchased a private right of way. The latter company has placed contracts for rails and will commence construction work at once.

ALBANY, N. Y.—The Monticello, Fallsburg & White Lake Railroad has been organized to build a new 16-mile trolley road through Sullivan County, N. Y., to carry passengers, freight and dairy and farm products between Monticello, Fallsburg and White Lake. The first section of the road is to be in operation by July 1, and is to be run in connection with the New York, Ontario & Western Railroad.

CLEVELAND, OHIO.—Mayor John Farley has presented to the City Council a second franchise extension ordinance in favor of the Cleveland City Railway Company. It shows several changes from the ordinance submitted to the Chamber of Commerce some weeks ago, although they are comparatively unimportant. It is not generally believed in Cleveland that the ordinance will pass, as the citizens are against it.

PHILADELPHIA, PA.—The stockholders of the Carbon County Electric Railway Company have voted to increase the present capital stock of $60,000 to $300,000. The increased capital will be used to improve the present line and to make extensions through Lehighton to Millport, and from Lehighton to Stroudsburg and the Delaware Water Gap. A new power house is also to be erected between Mauch Chunk and Lehighton.

CHICAGO, ILL.—The Chicago & Des Plaines Valley Electric Railway Company and the Des Plaines Valley Electric Railway Company have been consolidated under the name of the Chicago & Des Plaines Valley Electric Railway Company. The capital stock of the consolidated company is fixed at $1,000,000. The parties to the consolidation contemplate the construction of an electric line from Joliet into Chicago via the Des Plaines Valley. The first board of directors of the consolidated company are Clayton E. Crafts, Samuel G. Decoursey, Henry J. Crowley, Philip H. Gray, George Simpson Eddy and C. L. S. Tingley.

COLUMBUS, OHIO.—A deal has been practically closed for the purchase of the property of the Columbus, Buckeye Lake & Newark Traction Company by Gen. A. H. Warner of Marietta, Pomerene Brothers of Coshocton, Michael Spellacy, A. E. Appleyard and others of Columbus. The company has a capital stock of $1,000,000 and was organized about five years ago. It has changed hands several times and about 20 miles of road have been built. The new promoters are closely identified with the Columbus, London & Springfield and the Dayton, Springfield & Urbana roads, and it is said to be the intention to consolidate the three roads into one trunk line about 100 miles in length. There is talk also of connecting Newark with Zanesville, giving an additional 35 miles.

AKRON, OHIO.—The annual meeting of the stockholders of the Northern Ohio Traction Company was held Feb. 17. The former officers and directors were re-elected, with the exception of H. A. Everett, the former president, who retired in favor of E. W. Moore, of Cleveland. L. E. Beilstein will continue as general manager and will not go to Detroit, as has been reported. The annual report showed the gross earnings for the year as $425,880. The operating expenses were 61 per cent, and the interest charges $125,000. The dividend on preferred stock amounted to $25,000, leaving a balance of $30,000 in the treasury, to be applied to common stock. The stockholders voted favorably on the question of buying the property of the Akron & Cuyahoga Falls Rapid Transit Company; decided to increase the common stock of the company to $2,500,000, and voted to amend the articles of incorporation to authorize the construction of lines to Canton and Kent. The common stock of the company is at present $2,000,000 and the preferred $1,000,000. The entire stock, by the issue of $500,000 of new common stock, will amount to $3,500,000.

THE AUTOMOBILE.

THE AUTOMOBILE CLUB OF CALIFORNIA has arranged for quarters in the Parrott Building, San Francisco.

IN THE PHILIPPINES.—The first automobile in the Philippines is an electric machine, imported for the use of the Signal Corps.

AUTOMOBILE MAIL WAGON IN WINNIPEG.—Winnipeg, Manitoba, is to have an electrical automobile mail carrier for the conveyance of mail to and from stations and street box collections.

NEW YORK STATE.—In the State Senate, Mr. Hennesy has introduced a bill exempting from the application of Section 155 of the Highway Law regarding the posting of an advance guard to warn people of the approach of a steam traction engine, any carriage or motor vehicle propelled by steam developing less than 25 horse-power.

CHICAGO, ILL.—A strike occurred last week in the Illinois Electric Vehicle Transportation Company. The drivers, who organized a few months ago under the jurisdiction of the United Brotherhood of Electrical Workers, went out because of a system introduced by the company to change the wages paid from $2 a day of 12 hours to 20 per cent of the gross earnings. The men presented an agreement to Superintendent Jenkins calling for a wage scale of 16⅔ cents an hour, with a 12-hour day.

BOSTON, MASS.—The Automobile Club of New England has opened its new quarters on Newton Street, Brookline, the property being that formerly occupied by the Suburban Club, directly opposite the Country Club. The clubhouse has undergone such changes as to adapt it to its new uses that the former members of the old social club would hardly recognize it as the same building in which they once entertained and were entertained. Where handsome carriages and noble horses were once sheltered are now to be found the finest specimens of motor vehicles that the country affords. There were electric, gasoline and steam vehicles, making altogether as fine a collection as could be shown by any American automobile club.

NEW INDUSTRIAL COMPANIES.

THE W. G. NAGLE ELECTRIC COMPANY has been incorporated at Toledo, Ohio, with a capital stock of $50,000.

THE AMERICAN ELECTRICAL NOVELTY & MANUFACTURING COMPANY, of New York City, has been incorporated in Illinois with a capital stock of $25,000. The Illinois capital stock is $2,500.

THE MOTOR MANUFACTURING COMPANY has been incorporated in Eureka, Calif. Directors: A. L. R. Hendricks, D. C. McDoneld, F. W. Pease, F. E. Cook and G. T. Rolley. Capital stock, $25,000; subscribed, $930.

THE FRESNO MOTOR COMPANY has been incorporated, with Fresno, Calif., as the place of business. Directors: F. G. Berry, W. H. McKenzie, G. S. Calyuhoun, O. B. Olufs and J. W. Cate of Fresno. Capital stock, $100,000; subscribed, $9,500.

THE ELECTRIC INSULATION COMPANY, with a capital of $400,000, has been incorporated at Newark, N. J., to manufacture electric supplies. Incorporators: Elijah Woodward, Newark, N. J.; C. H. S. Woodward, Louis A. Ziegler, attorney, Newark, N. J.

THE AMERICAN WAVE MOTOR COMPANY was recently incorporated with Los Angeles, Calif., as the principal place of business. Directors: A. L. Stevens, V. G. Gifford, A. Villinger, D. S. Gillespie, W. A. Colwell, H. G. Watkins and W. C. Petchner. Capital stock, $300,000; subscribed, $150,000.

LEGAL.

ILLEGAL USE OF MAIL SIGNS.—Papers have been filed with United States District Attorney Evans by the postal authorities at St. Paul, Minn., looking to the prosecution of the Twin City Rapid Transit Company for an illegal use of the "U. S. Mail" sign upon its cars. The company carries the mail between St. Paul and Minneapolis, but has for a long time had the "U. S. Mail" sign painted upon the sides of numerous cars not engaged in this traffic. The statute imposes a penalty of from $100 to $500 fine per car. It is understood that labor organizations throughout the country have urged the Government to take steps to have such signs removed from street cars, it being alleged that they were used for the purpose of intimidating labor unions in case of strikes.

OBITUARY.

MR. T. H. McLEAN.—Thomas H. McLean, manager of the Toledo Traction Company, died of pneumonia at Toledo, O., on March 1. He was formerly manager of the Twenty-Third Street Railway of New York, the Citizens' Street Railway of Indianapolis, and the electric lines in the City of Mexico. He went to Toledo in 1898. He was a man of agreeable personality and marked ability, and stood high in the American Street Railway Association, of which he was an active member.

MR. JOHN P. MADDEN, deputy commissioner of highways of Long Island City, died last week in Texas of consumption. He was only 38 years old. At one time he ran for mayor of the Gleason bailiwick, and then began the publication of *Electrical Doings*, a paper of some merit. He dropped the enterprise after a couple of years and got into politics.

PERSONAL.

MR. T. F. RYAN has been elected a director of the Union Elevated Road of Chicago.

DENSMORE & LE CLEAR, the engineers, of Boston, are removing their offices from Exchange Place, in that city, to the Whittier Building, on Exchange Street.

IRA FRANCIS, city electrician of Los Angeles, Calif., has left that office to become the Southern California representative of the John A. Roebling's Sons Company.

MR. W. W. DONALDSON, of Baltimore, Md., an engineer of long experience in accumulator work, has become associated with the New York interests of the Gould Storage Battery Company.

MR. J. GILMOUR no longer represents the interests of the Whiting Foundry Equipment Company of Harvey, Ill., in New York and vicinity. He has been succeeded by Mr. Edward J. Etting.

MR. AXEL HULTMAN, of Stockholm, a Swedish governmental telephone engineer, is visiting this country on a tour of inspection, and has gone West after a study of the Bell system in New York.

MR. CHARLES T. YERKES, although he has sold out his street railway interests, will continue to reside in Chicago. He will devote himself to his London underground road and his newspaper the Chicago *Inter-Ocean*.

MR. F. H. NALDER, of the well-known English firm of Nalder Brothers & Thompson, electrical instrument manufacturers, is to sail on March 13 for the United States, where he has a great many friends and acquaintances.

MR. T. A. EDISON is reported from the South to have been enjoying the sights of Jacksonville, Fla., with Mrs. Edison and family, en route for his plantation near Punta Gorda, where he proposes to spend the month of March.

MR. CALVERT TOWNLEY, heretofore manager of the Boston office of the Westinghouse Electric & Manufacturing Company, has been promoted to the position of general agent, with headquarters at 120 Broadway, New York City.

MR. C. G. ROEBLING, a leading member of the house of John A. Roebling's Sons Company, is, we regret to say, undergoing an operation this week for appendicitis at Roosevelt Hospital. A speedy recovery is earnestly hoped by hosts of friends.

MR. W. P. HALL, of the Hall signal works at Garwood, N. J., and the well-known inventor of the electrical system bearing his name, is, it is stated, to conduct the revival meeting at Plainfield, N. J., under the direction of the Ministers' Association.

DR. M. I. PUPIN has been selected by Columbia University to be its representative at the ninth jubilee of Glasgow University, to be held in June. He has also been promoted to a full professorship with the title of Professor of Electro-Mechanics.

MR. W. W. MARKS.—It is understood that this well-known veteran cable manufacturer has connected himself with an important rubber insulating company as expert and superintendent of the works, news that will give much pleasure to many old friends.

MR. CLARENCE BUCKINGHAM has been elected president of the Northwestern Elevated of Chicago. Mr. Clarence A. Knight has been elected temporary president of the Lake Street Elevated, and Mr. J. B. Dennis of New York president of the Union Loop.

MR. R. L. WARNER, who has been in charge of the engineering and commercial work for the Westinghouse Electric & Manufacturing Company in Southern New England, has been promoted to the position of manager of the Boston office, to succeed Mr. Calvert Townley.

MR. J. AMBOR, an importer of electrical supplies and mechanical rubber goods, of Hamburg, Germany, is now in this country for a short time and will be glad to learn of any specialties and novelties he can represent. He may be addressed in care of the ELECTRICAL WORLD AND ENGINEER.

JUDGE J. M. THOMAS, the energetic president of the National Independent Telephone Exchange Association, whose headquarters are in Cleveland, is spending a good deal of time just now at the Holland House, New York, in order to keep in touch with the important developments now going on.

CAPT. G. O. SQUIER, U. S. N. Signal Corps, now laying Government cables in the Philippines, contributes a very interesting article on "The Influence of Submarine Cables upon Military and Naval Supremacy" to the last quarterly issue of the Proceedings of the United States Naval Institute.

MR. BENJAMIN HAYLLAR, JR., who for some time past has been connected with the Walker & Kepler electrical supply house, Philadelphia, has just become associated with the Mayer & Englund Company, 10 South Tenth Street, in that city. Mr. Hayllar's many friends wish him success in his new position.

MR. WM. J. BARRETT, of Los Angeles, Calif., who has heretofore ably looked after the interests of the John A. Roebling's Sons Company in Southern California, has resigned that position and will have charge of the Westinghouse Electric & Manufacturing Company's business hereafter in that territory.

MR. HENDERSON W. KNOTT, chief engineer of the Imperial Electrical Supplies, Ltd., is visiting this country and making arrangements for his company, which has a large connection all over the world. Mr. Knott has had engineering experience in this country and "knows the ropes." He will be here for a few weeks.

MR. CHAS. J. GLIDDEN, president of the subsidiary companies of the Erie Telephone System, is at Galveston, Tex., on a tour of inspection of the Erie Company's property. He will visit the principal cities of Texas, Arkansas, Minnesota, Wisconsin, Michigan and Ohio, returning to Boston the latter part of March.

MR. EDWARD WESTON and wife, while staying at the Waldorf-Astoria this week, had the exciting experience of finding a Brazilian in a closet in their room after retiring. The noise he made betrayed him, and the distinguished electrician was then, as usual, fully equal to the occasion. The intruder was soon locked up by the police.

MR. S. H. ROSENBLATT.—Zimmermann & Forshay announce that Mr. Sig H. Rosenblatt has been admitted to partnership in their firm and that the businesses become consolidated under the present firm name of Zimmermann & Forshay. The constant increase of their stock clientele renders an increased representation in the Stock Exchange necessary and is attained by the advent of Mr. Rosenblatt, who, with Mr. L. Zimmermann and Mr. L. Schafer, will compose their membership in the board. Mr. Rosenblatt has a wide circle of acquaintances and friends in the electrical field.

COL. W. S. ROGERS, a prominent man in the old Brush electric lighting industry, is promoting an enterprise to cure consumption by electricity. His headquarters are in Cleveland. He says: "The company will be launched shortly. At this time I cannot say just whom you will find in the directorate or in the official capacities, but they will be representative financiers of Cleveland, and there are also a few from the East. The company is financing a new invention. An absolute cure for consumption has been found. Electricity will play a prominent part in the cure we are advancing, and we anticipate that the ends we aim at will be attained. Medicine plays no part whatever."

MR. J. P. ORD has resigned the second vice-presidency of the General Electric Company. It was reported that Mr. Ord had resigned to become head financial man of the United States Steel Corporation. Mr. Ord, however, denies positively that there is any truth in the report. He would say nothing regarding his future plans. As comptroller of the company and of the old Edison General Electric Company, Mr. Ord has long enjoyed a well-deserved reputation for financial ability of a high order. His annual reports have stood high for their clearness and fullness and have won general commendation from the financial and lay press. Of late his services have been called in for some of the larger consolidations and reorganizations.

MR. T. C. WOOD, president of the Ball & Wood Engine Company, has just done a very graceful thing. A special dispatch from Annapolis, Md., of March 2, says: "At the Naval Academy this morning a new stand of colors, the gift of a graduate of the academy, Thomas C. Wood, of New York, an ex-lieutenant in the Navy, was presented by his daughter, Miss Jessie C. Wood, to the battalion of naval cadets. In presenting the colors Miss Wood said: 'It is to me a delightful duty to present to you these colors, the gift of my father, once a member of this battalion, and who in the Spanish-American war renewed his allegiance to the service he loved and still loves so well. In his name I present them. They are the colors of your country, and I am sure they will be safe in your hands.'" Mr. Wood, as an officer on the "Mayflower," had a very warm half hour in the ever-memorable destruction of Cervera's fleet at Santiago.

Trade Notes.

CINCINNATI, OHIO.—The Jones Bros.' Electric Company has increased its capital stock from $136,000 to $400,000.

THE SANBORN MARSH ELECTRIC COMPANY has succeeded the Advance Electric Company, Indianapolis, Ind.

THE AMERICAN BRIDGE COMPANY is furnishing to Wm. Young & Company, Mexico City, Mex., eight bridges to be erected over the Sacramento Canal at Torreon, Mex.

OIL FILTERS.—The Badger Brass Manufacturing Company, Kenosha Wis., has just installed a No. 1 special Cross oil filter, purchased from the Burt Manufacturing Company of Akron, Ohio.

THE ELECTRIC APPLIANCE COMPANY, Chicago, owns the factory in which "Crystal Lake" cross arms, pins and brackets are made. It claims, therefore, to be in an excellent position to make prompt and satisfactory shipments.

TRANSFORMERS.—Core type transformers for three-wire secondary service form the subject of a pamphlet of recent issue by the General Electric Company. This type of transformer is well described and illustrated by general and sectional views.

ELECTRIC WINCHES FOR WHITE STAR STEAMERS.—It is stated that the White Star Line will replace its steam winches by electric winches on its steamers for the purpose of handling the cargo, gang planks, etc. The contract for the installation of the electrical plant, it is stated, has been signed.

THE ELECTRIC SUPPLY & CONSTRUCTION COMPANY, of Alliance, Ohio, has commenced business at 17 South Liberty Street, that city. It will carry a large line of electrical supplies and apparatus and will do electrical construction work of all kinds. Mr. S. Franklin Jones is at the head of the company.

FIRE ALARM CONTRACT.—Pasadena, Calif., has just closed a contract with the Gamewell Fire Alarm Telegraph Company for a four-circuit storage battery switchboard and 100 chloride accumulators for the city's 24-box fire alarm system. Additional apparatus for a new engine house is also included in the contract.

STEAM GENERATORS.—The Wickes vertical water tube safety steam boiler, manufactured by Wickes Brothers, Saginaw, Mich., is very completely described in a pamphlet issued by the company. Various illustrations scattered throughout the pages show the process of manufacture, and sectional views of the boiler; also views of several boiler plants.

NEW STREET CAR PLANT.—Mr. G. C. Kuhlman, of Cleveland, manufacturer of street cars, is preparing to incorporate a stock company with large capital to take over his business. Plans are being considered for the erection of a large plant which will be located in the vicinity of Cleveland. It is stated that the new plant will have four times the capacity of the present factory in Cleveland.

NEW BOSTON OFFICE.—The Standard Underground Cable Company has removed the headquarters of its Northeastern sales department to the Tremont Building, Tremont and Beacon Streets, Boston, Mass. Mr. A. B. Saurman is manager of this department and will be glad at any time to meet the company's customers and friends. Mr. Saurman has exhibit samples of the company's wires, cables and accessories.

NEW TYPE DIRECT-CURRENT MOTOR.—The Emerson Electric Manufacturing Company, St. Louis, Mo., is placing upon the market a new type of direct-current motor. This machine is described and illustrated in Bulletin No. 3028, just issued by the company. These machines are made in sizes from ¼ to ½ actual horse-power. The company intends to make larger sizes as soon as the designs can be completed.

MECHANICAL DRAFT.—A third edition of Walter B. Snow's lecture on "The Influence of Mechanical Draft upon the Ultimate Efficiency of Steam Boilers" has just been issued by the B. F. Sturtevant Company of Boston, Mass. It treats of the different methods of application of fans for producing boiler draft, of the relative cost as compared with a chimney, of the possible economy in first cost of boilers, running expense for fuel, etc. Copies may be obtained upon application.

THE STERLING ELECTRIC MOTOR COMPANY, of Dayton, Ohio, is sending out its new price list and schedule of ratings of Sterling electric motors, which will be mailed upon application to any one interested. It is claimed that the company's success in supplying motors for active service is due to its devoting its entire time and attention to the manufacture of small motors of one horse-power and under, and that this concentrated effort has made the Sterling motor all that the name implies.

THE STANDARD PNEUMATIC TOOL COMPANY, of Chicago, manufacturer of the "Little Giant" air tools and appliances, has moved its New York offices from 619 Washington Life Building to more commodious quarters at 611-612-613 of the same building, this being necessitated on account of the great increase in its business in Eastern and foreign territory. All shipments for Eastern and foreign customers will be made from New York instead of Chicago, thus expediting the delivery of machines.

THE CREST MANUFACTURING COMPANY, of Cambridgeport, Mass., has sent out with its motors a number of the Loomis carburetters, made by the Loomis Automobile Company, of Westfield, Mass. The results have been so excellent that it has given an order for 250 carburetters, which is shortly to be followed by another large order. It was the combination of the Crest motor with the Loomis carburetter that did the extraordinary hill climbing at the Cycle and Automobile Show in Madison Square Garden in January.

A HANDY ATLAS.—The Bullock Electric Manufacturing Company is distributing a small atlas of the world. It points out on the cover that its machines are in operation in nearly every country shown in the atlas. This little work will be very handy and serviceable to those fortunate enough to secure a copy. It is of convenient size for desk use and is always at hand for reference. There are about 90 pages of maps, besides a list of the principal cities of the United States, giving their population at the last and preceding censuses. A few of the leading types of Bullock machines are also illustrated.

MESSRS. CHARLES H. BESLY & COMPANY, 10 and 12 North Canal Street, Chicago, Ill., are now in a position to handle their increasing business promptly and carefully. Numerous orders for their Helmet oil, Perfection and Bonanza oil cups are being received. They are very busy in their tap and die department at their factory in Beloit, and are receiving many orders for the Gardner disk grinders. Among others, recent shipments have been made to Ohio, Massachusetts and New York, and also to the Rock Island Arsenal at Rock Island, Ill. Their new 300-page catalogue is now ready for distribution and will be mailed free to any address upon application.

POWER TRANSMISSION MACHINERY.—The Hyatt flexible roller bearing as an anti-friction appliance is stated to be a saver of power. It is said that this bearing will save from 25 to 60 per cent of the frictional load, according to the class of machinery, the load, size of bearing, etc. This bearing, which has been illustrated in these columns, is described and illustrated in a new pamphlet just issued by the company. Many styles of roller bearings are shown. During the last few months the Hyatt Roller Bearing Company, Harrison, N. J., has largely increased its facilities and is now keeping constantly on hand a large stock of standard goods, from which shipments can be made promptly.

ELECTRIC TRAVELING CRANES.—The line of electric traveling cranes manufactured by Pawling-Harnischfeger, Milwaukee, Wis., is described and illustrated in a very artistic manner in a catalogue of 132 pages. Many very excellent half-tones show various establishments throughout the country using this firm's cranes, and others illustrate the different types of cranes turned out by the concern. Besides the large line of standard cranes, the firm also designs and erects many of special character for handling material in situations where a crane of the usual type would be inadaptable. The motors used in these cranes are of the firm's own make, and designed especially for this service. They are of the four-pole steel-clad type, and have, it is stated, very large starting torque and slow speeds. Each motor has its own reversible controller and rheostat.

ELMER G. WILLYOUNG, the instrument expert and manufacturer, has been compelled, owing to the increasing demand for his instruments, to seek larger quarters, and has removed his office, drafting room, show room and experimental laboratory to 10 Frankfort Street, New York (just opposite the *World* building). Here he has 1500 square feet of space. His laboratory is being very thoroughly equipped for all high grade standardizing work, and such work will now be vigorously solicited in addition to the regular trade. As a part of the equipment may be mentioned a complete set of Reichsanstalt standards of resistance from 10 ohms down to 0.0001 ohm, and carrying current from 1 to 10,000 amperes. A very complete photometer, with rotator, improved Lummer-Brodhun screen, etc., will also be set up. Mr. Willyoung publishes a very complete line of catalogues and circulars, which are free to interested parties.

THE VICTOR TURBINE.—Some valuable improvements have been made in the details of construction of the Victor turbine, manufactured by the Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio. These, it is stated, have greatly strengthened the wheel, rendering it more durable under the severe shocks and strains incident to modern practice in the use of water power. The company has just issued a catalogue of 184 pages, describing and illustrating many of the wheels manufactured by it. The wide range of work done by this company is very clearly indicated in this catalogue. The company builds numerous special designs of wheels not illustrated. It makes a specialty of complete water power plants for all purposes and is prepared to send competent engineers to examine water powers and make plans for their improvement. The catalogue includes illustrations and descriptions of the Victor high-pressure turbine, which is stated to be giving excellent satisfaction under high loads.

THE PARKER STEAM GENERATOR, built by the Parker Engine Company of California, is a steam boiler constructed on practically new lines. The principal claims made for it are that it is highly efficient, economical and safe. In developing this boiler the aim of the manufacturer was to combine the economizer and boiler in one compact and simple machine, requiring less space and reducing the first cost; to maintain a positive flow of water and steam within the tubes always in one direction, ensuring the tubes permanently against fire and securing absolute safety; to provide full release for the steam, and to eliminate the effects of bad water and hard firing, varying pressures, etc.; to provide accessibility to every square inch of surface, both inside and outside; to make leaks impossible, and, finally, to secure perfect reliability in operation under the roughest usage. A description of the complete construction of the boiler is given in a pamphlet of recent issue. The subject matter is also illustrated with general and sectional views of the apparatus. The home office of the company is at 123 Crocker Building, San Francisco, Calif., and the general offices and sales department in the Drexel Building, Philadelphia.

FOR INSTANTANEOUS FIRE ALARMS.—A revolution in the method of giving fire alarms was undoubtedly started last Wednesday when the New York Board of Fire Underwriters passed a resolution unanimously which approved the fire detecting wire now universally known as the Montauk Multiphase cable. The words of the resolution were as follows: "Resolved, That this board approves of the fire detecting wire hereafter described, as a fire alarm device for use in dwelling houses and other buildings in which it can be substituted for bell wires, and also by judicious distribution and arrangement in elevator and dumbwaiter shafts, coal and wood cellars, closets, store rooms and other unoccupied rooms, so as to give timely warning of fire and thus contribute to the greater safety of human life. (This fire detecting wire consists of two conductors. The central wire or core, which forms one side of the circuit, has a thick coating or wall of fusible metal; over this is an insulated coating. A number of fine wires are wound over this coating to form a second conductor. The whole is then covered with suitable insulation. When flame or a dangerous degree of heat comes into contact with this wire it will establish electrical connection between the two conductors and give a signal on the premises equipped.)" The description of the wire attached to this resolution conveys some idea of its manifold usefulness. It is manufactured to fuse at any desired temperature, from 150 degs. F. to 370 degs. F. The adoption of this twentieth century device by the New York Board of Fire Underwriters is adequate proof that they are on the alert.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED FEB. 26, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

668,622. SECONDARY BATTERY; W. R. Bowker, Waltham, Mass. App. filed Feb. 16, 1900. A storage battery electrode, comprising a porous receptacle filled with the active material, and a conducting plate or sheet having flanges extending beyond the active material and inclosing the edges of the porous receptacle to prevent the escape of the active material, and form vertical and horizontal conducting surfaces.

668,630. ELECTRIC LAMP PROTECTOR; E. Eckl, Milwaukee, Wis. App. filed March 31, 1900. The lamp socket is set into the face of a signboard and a protecting shield surrounds the opening into which the neck of the lamp passes.

668,650. DOOR LOCK; C. J. Letzing, Boston, Mass. App. filed Sept. 20, 1899. Details.

668,653. TELEPHONE SIGNALING DEVICE; W. O. Meissner, Chicago, Ill. App. filed July 5, 1898. The movement of the hook switch is used to open and close the induction coil circuit a number of times to send in the calling current, thereby dispensing with the magneto.

668,661. ELECTRIC BATHING APPARATUS; O. Schneider, New York, N. Y. App. filed July 12, 1900. A bath tub provided with an arrangement of electrodes for passing a current through various parts of the body.

668,662. MOLD BOX OR FORM FOR CONDUIT JOINTS; J. O. Therien and A. E. Gregory, Minneapolis, Minn. App. filed Oct. 11, 1900. A form placed around the joint to receive cement.

668,662. ELECTRIC SWITCH; J. H. Spangler, Pittsburg, Pa. App. filed Feb. 21, 1900. The switch is moved by a solenoid thrown into circuit by the motorman operating through his controller. The movement of the switch is cushioned by an air cylinder.

668,664. STORAGE BATTERY SYSTEM FOR SIGNALING CIRCUITS; N. H. Suren, Needham, Mass. App. filed June 19, 1899. A switch for throwing the battery into and out of the circuit without causing a tap of the bell.

668,666. JUNCTION BOX FOR ELECTRIC LIGHTING SYSTEMS; M. Waddell, New York, N. Y. App. filed Jan. 31, 1900. A box containing a switch whereby the battery can be connected in series for charging and in parallel for discharging.

668,667. CHARGING SYSTEM FOR SECONDARY BATTERIES; M. Wad-

dell, New York, N. Y. App. filed Feb. 15, 1900. Circuit breakers are automatically operated when the engine is reversed, the engine being used normally for propelling forward, but occasionally for backing.

668,689. ELECTRIC ATTACHMENT FOR RAILWAY SCALES; M. H. Reed, Pittsburg, Pa. App. filed March 30, 1900. An electric signal used in connection with railway trains to indicate whether or not all conditions are secured for properly weighing the car.

668,690. ELECTRIC ACCUMULATOR; P. F. Ribbe, Charlottenburg, Germany. App. filed April 30, 1900. A folded plate having slots with strips threaded through the slots to hold the folds of the plate apart.

668,702. TELEPHONE TRANSMITTER; D. H. Wilson, Chicago, Ill. App. filed April 29, 1899. Granulated carbon is placed in a holder in such shape as to make the body of the carbon thicker through the centre than at the edges, and being mounted so that the middle portion only comes in contact with the centre of the diaphragm.

668,708. ELECTRIC CAR LIGHTER; C. A. Bernhardt, Detroit, Mich. App. filed Jan 15, 1900. Details.

668,710, 668,711 and 668,712. ELECTRIC RAILWAY; G. H. Davis, New York, N. Y. App. filed Sept. 15, 1900. (See Current News and Notes.)

668,761. APPARATUS FOR CONNECTING STORAGE BATTERIES WITH CHARGING LINES; N. H. Suren, Needham, Mass. App. filed June 29, 1899. An arrangement of switches whereby the batteries can be connected with the charging circuits in different ways, in order to match the electromotive force of the batteries to that of the charging current.

668,779. APPARATUS FOR CONTROLLING CONNECTIONS OF STORAGE BATTERIES WITH CHARGING CIRCUITS; N. H. Suren, Needham, Mass. App. filed June 29, 1899. Relates to the preceding patent.

668,781. ELECTRIC TRACTION SYSTEM; S. P. Thompson and M. Walker, London, Eng. App. filed Oct. 22, 1897. A switch for connecting studs in the roadway with the feeder, consisting of a magnetizing coil placed around a plunger which occupies that part of the magnetic field in which the resulting magnetic pull, whatever current may be passing in the coil, is less than the resultant of all the forces which tend to keep the switch open.

668,819. RAILWAY SIGNALING APPARATUS; W. Hume, New Broad Street, County of London, Eng. App. filed Oct. 6, 1898. A contact carried by a train is constructed with a certain relation to certain contacts in the track, so that each train will, in signaling ahead, indicate what particular train it is.

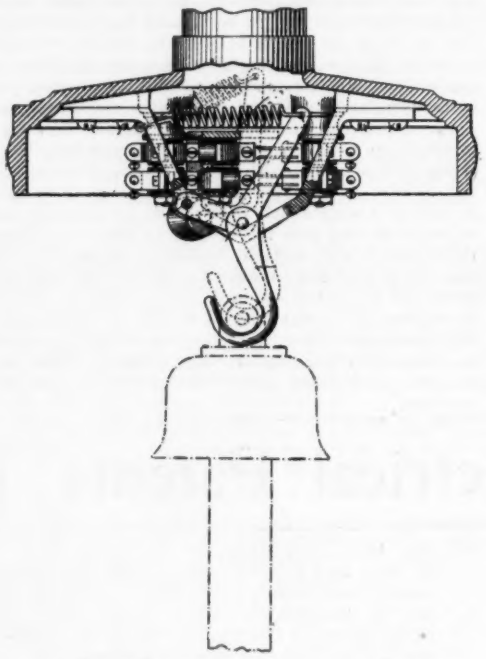
668,838. VOLTAIC BATTERY; H. D. F. De Lavison, Paris, France. App. filed July 19, 1899. Heated air is conducted to the interior of a cell in close proximity to the copper electrodes, so as to absorb the disengaged hydrogen.

668,868. ALTERNATING CURRENT SERIES ARC LAMP; M. H. Baker, New York, N. Y. App. filed Sept. 5, 1899. Relates particularly to the cut-out, the same being included in a shunt across the arc, independent of the usual shunt magnet circuit.

668,869. RELAY; Sidney George Brown, Bournemouth, England. App. filed Nov. 14, 1899. A dynamo has such a field structure that normally no current is induced in the armature. When arrival currents are led through auxiliary conductors on the field, the magnetic balance is destroyed and the armature furnishes current.

668,886. ELECTRIC ARC LAMP; P. H. F. Spies, Mount Vernon, N. Y. App. filed June 5, 1900. Improvements in the clutch and in various details of the lamp.

668,904.—Incandescent Electric Lamp.



668,905.—Automatic Circuit Closer for Arc Lamp Circuits.

668,887. ELECTRIC SWITCH; P. H. F. Spies, Mount Vernon, N. Y. App. filed Aug. 2, 1900. A separable switch adapted for raising and lowering chandeliers.

668,889. TELAUTOGRAPH; G. S. Tiffany, Evanston, Ill. App. filed Oct. 19, 1900. Relates to the means whereby the transmitting tracer effects the movement of the receiving pen into and out of contact with the paper; also means for maintaining certain controlling parts in a state of vibration to reduce the friction of such moving parts.

668,890. TELAUTOGRAPH; G. S. Tiffany, Evanston, Ill. App. filed Oct. 19, 1900. Relates to the preceding patent.

668,891. TELAUTOGRAPH; G. S. Tiffany, Brooklyn, N. Y. App. filed Nov. 20, 1900. An improved inking device.

668,892. TELAUTOGRAPH; G. S. Tiffany, Brooklyn, N. Y. App. filed Dec. 20, 1900. Relates to the three preceding patents.

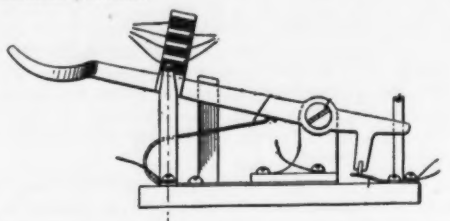
668,893. TELAUTOGRAPH; G. S. Tiffany, Brooklyn, N. Y. App. filed Dec. 20, 1900. Belongs to the system described in the preceding patents to the same inventor.

668,894. TELAUTOGRAPH; G. S. Tiffany, Brooklyn, N. Y. App. filed Dec. 20, 1900. Ditto.

668,895. METHOD OF TELAUTOGRAPHIC TRANSMISSION; G. S. Tiffany, Brooklyn, N. Y. App. filed Dec. 21, 1900. Ditto.

668,903. ELECTRIC BOND FOR RAILWAY RAILS; H. P. Brown, Montclair, N. J. App. filed April 7, 1900. The bond is a strip inserted between the web of the rail and the fishplate and having associated with it a spring or springs for holding its body portion in contact with the rail.

668,904. INCANDESCENT ELECTRIC LAMP; C. H. Chase, Chicago, Ill. App. filed Dec. 8, 1900. The neck of the lamp, just above the base, is formed with a bulging annulus, from which the moisture drips before it can reach the metallic portions.



668,653.—Telephone Signaling Device.

668,905. AUTOMATIC CIRCUIT CLOSER FOR ARC LAMP CIRCUITS; G. R. Davison, Newark, N. J. App. filed July 24, 1900. The weight of the lamp on its supporting hook acts in opposition to a spring to control the local circuit to the lamp.

668,909. ELECTRIC SWITCH; C. J. Doran, J. C. App. filed Sept. 11, 1900. Details.

668,931. TROLLEY CATCHER; F. W. Powers and M. L. Snyder, West Lafayette, Ind. App. filed Jan. 8, 1900. The rapid movement of the trolley pole when the wheel leaves the wire is utilized to throw a retaining device into operation to automatically lower the pole.

668,940. ELECTROMAGNETIC SEPARATOR; G. H. Waring, Tyrone, Pa. App. filed Jan. 30, 1900. A drum having annular polar surfaces of varying width and corresponding grooves between them of varying width, so that each particle of ore shall pass equally with every other particle through one or more zones of equally intense magnetic attraction.

668,941. METHOD OF MAGNETICALLY SEPARATING ORES; G. H. Waring, Tyrone, Pa. App. filed April 21, 1900. Method patent accompanying the preceding patent.

668,962. MOTOR GROUPING SYSTEM; F. H. Shepard, New York, N. Y. App. filed Jan. 21, 1901. (See Current News and Notes.)

668,967. SELECTIVE SIGNALING APPARATUS; John A. Barrett, Summit, N. J. App. filed Sept. 20, 1900. Provides a system of telephone station bells adapted for selective signaling on a four sub-station line, the bells have their selectivity determined by differences in arrangement of their magnet windings and in the connection thereof to the main circuit, and in the mode of transmitting the ringing circuit through the main circuit.

668,978. CONTROLLING DEVICE FOR ELECTRIC MOTORS; A. G. Carlson, Chicago, Ill. App. filed May 19, 1899. A coil conductor and a core therefor made up of pieces of magnetic and non-magnetic material; means for separately energizing different portions of the coil causing them to cooperate with the magnetic pieces of the core to produce a movement of the core.

668,979. CONTROLLING DEVICE FOR ELECTRIC MOTORS; A. G. Carlson, Chicago, Ill. App. filed May 19, 1899. Relates to the preceding patent.

668,987. ELECTRIC ATTACHMENT FOR ELEVATORS; D. B. Fleck, Portland, Ore. App. filed Feb. 2, 1900. Details of a signaling system.

669,007. PROCESS OF MANUFACTURING ZINC AMALGAM PLATES; G. T. Eyanson and A. J. Shinn, Philadelphia, Pa. App. filed June 11, 1900. A zinc plate is placed between two layers of zinc amalgam in a mold, and the same are united by pressure and heat.

669,015. ELECTRIC ARC LAMP; G. Rasmus, New York, N. Y. App. filed Nov. 30, 1900. Details.

669,051. DEMAGNETIZER; O. S. Walker, Worcester, Mass. App. filed July 31, 1899. Two magnetic bodies are arranged to be magnetically united by the article to be demagnetized, and a rotating electromagnet is arranged to bring its poles into proximity with said bodies to change their polarity.

669,052. ATTACHMENT FOR STATIC ELECTRICAL MACHINES; G. Werber, Washington, D. C. App. filed April 24, 1900. A section of insulating material is interposed in the discharge rod of either the positive or negative pole of the machine.

669,055. ELECTRIC ARC LAMP; M. H. Baker, New York, N. Y. App. filed Sept. 5, 1899. An adjustable counter-balance is applied to the carbon carrier and tube.

669,056. INCLOSED ARC LAMP; M. H. Baker, New York, N. Y. App. filed March 12, 1900. The shunt magnet causes a movement of the lower carbon and also operates the upper carbon clutch.

669,057. ELECTRIC ARC LAMP; M. H. Baker, New York, N. Y. App. filed March 12, 1900. A modification of the preceding patent.

669,058. ELECTRIC AMALGAMATOR; L. H. Barricks, San Francisco, Cal. App. filed Aug. 6, 1900. Consists of electrolytic boxes having vertical porous partitions, pivotal sectional sluices and supports adapted to an incline whereby the boxes, riffles and sluices may be arranged in series.

669,064. SECONDARY BATTERY; L. W. Collins, Chicago, Ill. App. filed July 7, 1899. Horizontal troughs are set into notches in the frame and welded or fused in place.

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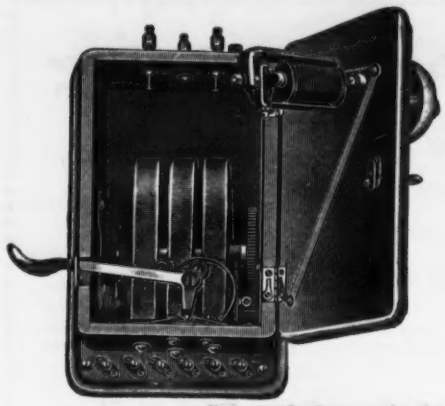

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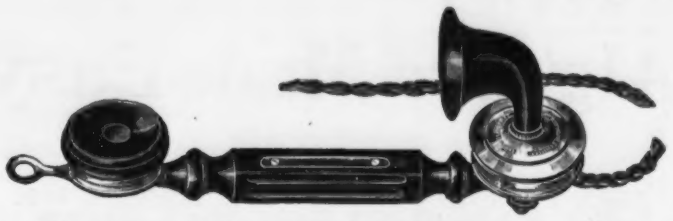

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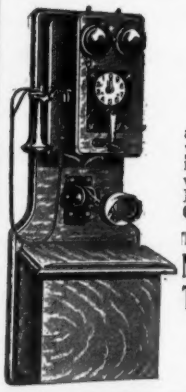

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